AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

JULY 1, 1955

In This Issue

New 175 Hp TurboDiesel with 4 Valves per Cylinder
Engineering Highlights of SAE Summer Meeting
Outstanding Machining Operations on Chevrolet V-8
Budd Establishes Extensive Plastic Tooling Setup
Engine for One-Year Operation without Service
Better, Lower Cost Axle Shafts by Induction Hardening

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A CHILTON PUBLICATION

Seven years service for STANOIL Industrial Oil at David Bradley Mfg. Works —No down time for lubrication

L. R. Cummings (left), Standard lubrication specialist, inspects sample of STANOIL with Robert C. Menken, Plant Engineer of David Bradley Manufacturing Works. Larry Cummings has been serving industrial customers for Standard Oil since graduation from Standard's Sales Engineering School. His mechanical engineering degree from Tri-State College of Indiana qualified him for this work. Customers of Larry's find this experience and background pay off for them.

Seven years ago David Bradley Mfg. Works installed 900 gallons of STANOIL Industrial Oil in an HPM press. There's been no down time required for lubrication maintenance since. A pump by-pass screen filter is the only filtering the oil receives, yet the system continues clean. In March, 1954, an analysis of the oil showed:

Viscosity @ 100° F.	— 980
Color, NPA	— 6
Neutralization No.	— .11

STANOIL Industrial Oil has long been at work for Bradley. Successful operations with it in other equipment caused Bradley engineers to specify STANOIL for this installation.

The HPM double acting, fast traverse hydraulic press reported on here is used to draw the upper frames for the David Bradley Tri-Trac, compact farm tractor. The Tri-Trac is the newest implement in the Bradley line. Bradley has been making farm implements since 1832.

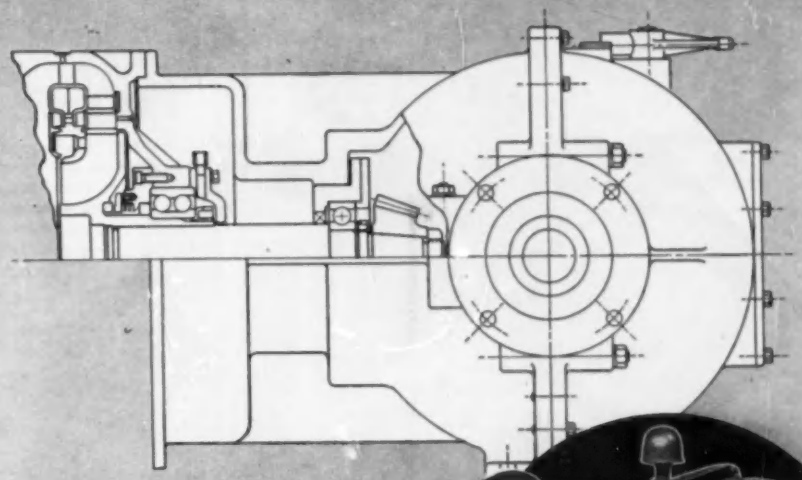
Like to know more about STANOIL? Perhaps it can serve you as efficiently as it is serving David Bradley. Lubrication specialists in any Standard Oil office will be happy to help. In the midwest, a call to one of them will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

David Bradley Tri-Trac, handy piece of farm equipment gives farmer new opportunity for mechanization at low cost. Upper frame on which gasoline tank is mounted, is part formed in HPM press.

STANDARD

STANDARD OIL COMPANY
(Indiana)

Now... get easier control of power through a wide range of torque conditions



Compact, heavy-duty Cotta Right-Angle Drive designed especially for power transmission on a switching locomotive.

with special Engineered-to-order COTTA TRANSMISSIONS

Typical of Cotta's ability to develop special transmissions for specific needs is this forward and reverse transmission, right-angle drive. On a switching locomotive it provides a flow of power through a wide range of torque conditions. At the same time, it has all the ruggedness and lifetime stamina which characterize transmissions *built by Cotta!* Operators of railcars, winches, drilling rigs, trucks, hoists and other heavy-duty mobile units are enthusiastic about the easy operation and increased efficiency of these compact mechanical drives.

If you are considering torque convertors for your mobile equipment, and you need a special transmission with job-proved, heavy-duty features — input torque between 150 to 2000 foot pounds — come to Cotta!

THIS INFORMATION WILL HELP YOU

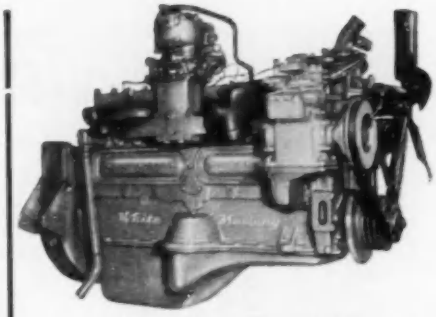
Diagrams, capacity tables, dimensions and complete specifications sent free on request. Just state your problem — COTTA engineers will help you select the right unit for best performance. May we work with you?

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS

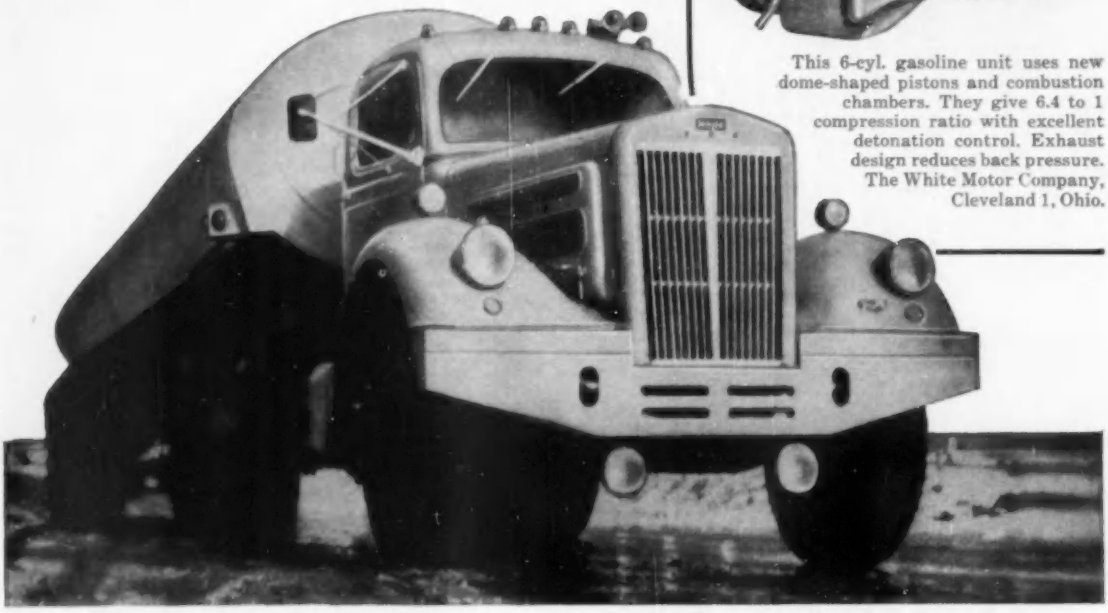
An Assurance of Dependable Service

COTTA
HEAVY-DUTY TRANSMISSIONS
"Engineered-to-order"

More power per pound. A vehicle powered by new White Mustang, benefits from strength, toughness, wear resistance and other properties in vital engine parts made from alloys containing nickel.



This 6-cyl. gasoline unit uses new dome-shaped pistons and combustion chambers. They give 6.4 to 1 compression ratio with excellent detonation control. Exhaust design reduces back pressure. The White Motor Company, Cleveland 1, Ohio.



White Tractor shows heels

...Packs kick of 200 hp White Mustang

A notable development powers this new lightweight payload tractor. The White Mustang engine for hauling bigger payloads.

Equally notable is the way White engineers use nickel alloys. Look at these typical applications.

Exhaust Valves, stem & head	Cr.-Ni Alloy (10½ to 12½% Ni)
Inlet Valves, stem & head	Alloy steel (0.40 to 0.70% Ni)
Connecting rods	SAE 3130 steel (1 to 1½% Ni)
Stressed bolts & nuts	SAE 3130 steel (1 to 1½% Ni)
Flywheel	Alloy cast iron (0.90 to 1.65% Ni)
Cylinder head & crankcase	Alloy cast iron (0.50% Ni)
Top piston ring insert	Type 1 Ni-Resist (13-17% Ni)

Why do they use nickel alloys?

Take Ni-Resist, for example. It resists heat, corrosion, metal-to-metal wear and galling. Its control of ring groove wear not only saves your oil, but stops needless power loss due to "blow by." Thus, you get more mileage. And you also enjoy longer piston life with less maintenance. Records prove this.

In a similar way, the other components containing nickel help to improve Mustang performance.

Properties of nickel alloys may be controlled to meet both fabricating and service demands. That's why it will pay you to specify them for your products.

Make use of our wide experience in solving all sorts of metal problems. Whatever the difficulty facing you, send us details. We'll be glad to give you our suggestions.

INCO TRADE MARK

Write for: List A of available publications. Its simple form makes it easy for you to outline your problem.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

JULY 1, 1955 — VOL. 113, NO. 1

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• Cleveland worm gear speed reducer installed on tumbling barrel in the malleable iron foundry of Superior Steel and Malleable Casting Co., Benton Harbor, Mich.

CLEVELANDS help castings come clean

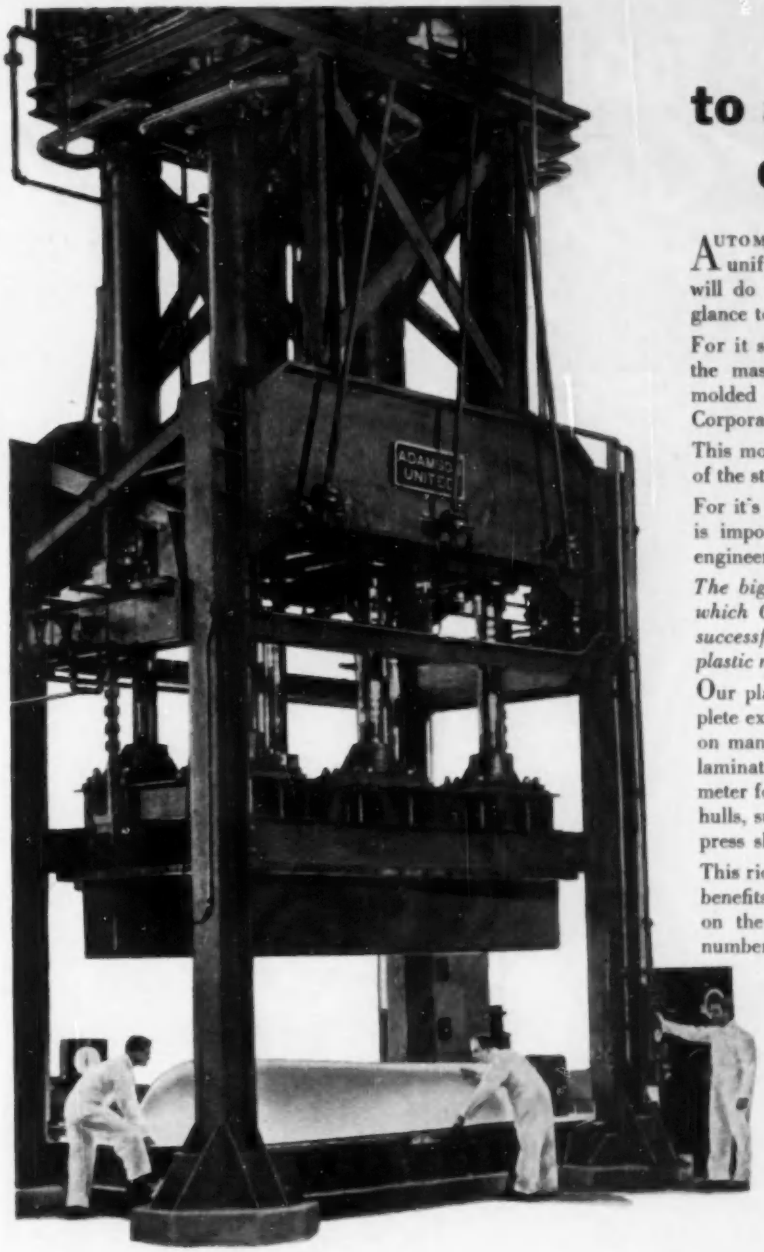
TUMBLING barrels took a turn for the better in a Michigan foundry when Cleveland worm gear drives went to work. Used for cleaning malleable iron castings, the barrels were converted from a belt line drive shaft to individual Cleveland speed reducers. Result—dependable, space-saving Clevelands transmit power smoothly and uninterruptedly. Operations and efficiency are improved.

These sturdy, space-saving Clevelands will serve economically for years. Experience proves that Cleveland case-hardened steel worms and nickel-bronze gears actually improve with use. Clevelands maintain their efficiency, will be as reliable ten or thirty years after installation as the day they first start on the job.

Find out what Cleveland can do for your operations, before you buy or modernize equipment. Catalog 400 gives you the full story, shows how Clevelands can make hefty savings for you. Write for your free copy today. The Cleveland Worm and Gear Company, 3274 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers



answer to a pressing question

AUTOMOTIVE manufacturers seeking to unify their designs and to be competitive will do well to give more than a passing glance to the scene pictured here.

For it shows one of our big presses for the mass production of large reinforced molded plastic items at Goodyear Aircraft Corporation.

This modern and large facility is only part of the story.

For it's not just the size of the press which is important to automotive designers and engineers.

The big thing is the experience and skills which Goodyear Aircraft has garnered in successful production of large integrated plastic moldings.

Our plastics pioneers have produced complete exterior structural sections now flying on many of today's high-speed jet aircraft, laminated plastic radomes 20 feet in diameter for airships—as well as one-piece boat hulls, such as the one being lifted from the press shown here.

This rich experience can be turned into real benefits for automotive folk who have an eye on the future – who want to reduce the number of parts, integrate designs, reduce assembly time and eliminate costly progressive dies, tools and jigs.

Our extensive design experience—our success in meeting the exacting requirements of the aeronautical product—foretells an exciting future for low-cost commercial applications of Goodyear skills and facilities in large molded plastics.

The benefits can be yours

We invite you to write:
Goodyear Aircraft Corporation,
Dept. 9311G, Akron 15, Ohio. Plants in
Akron and Litchfield Park, Arizona.

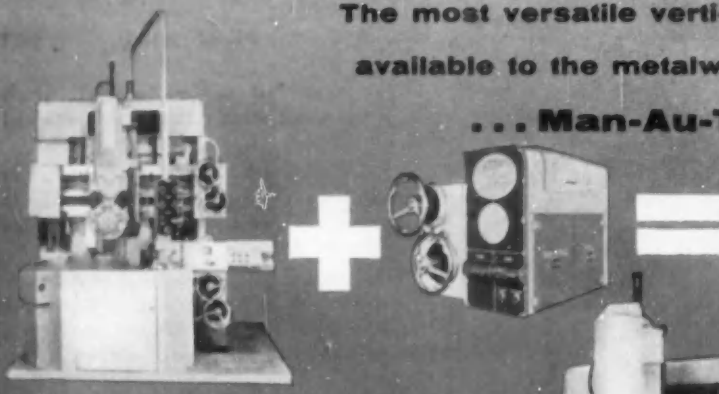
GOODYEAR AIRCRAFT

New Materials and Methods for Industry—the result of aeronautical pioneering

Machine Tools for *Today* and *Tomorrow!*

The most versatile vertical turret lathe available to the metalworking industry...

... Man-Au-Trol, Model 75



AVAILABLE IN SIX SIZES, 26" THROUGH 76" IN INCREMENTS OF 10".

Versatile because at the time of purchase should your production output require only a Cut Master V.T.L., Model 75 and later increase so that automatic operation is desirable, a Man-Au-Trol Conversion Unit can be added to the Cut Master *right in your plant.*

The Man-Au-Trol Conversion Unit directs the machine through all the functions the machine is capable of performing — automatically — by use of control and function drums. Machine down time for job change-over is reduced to a minimum since the control drum can be pre-set in advance and placed in the machine in a matter of seconds.

Your Bullard Sales Engineer will be glad to fully explain all of the technological advantages that are incorporated in the Man-Au-Trol, Model 75 and apply them to your machining problems.

THE MACHINE TOOL SHOW

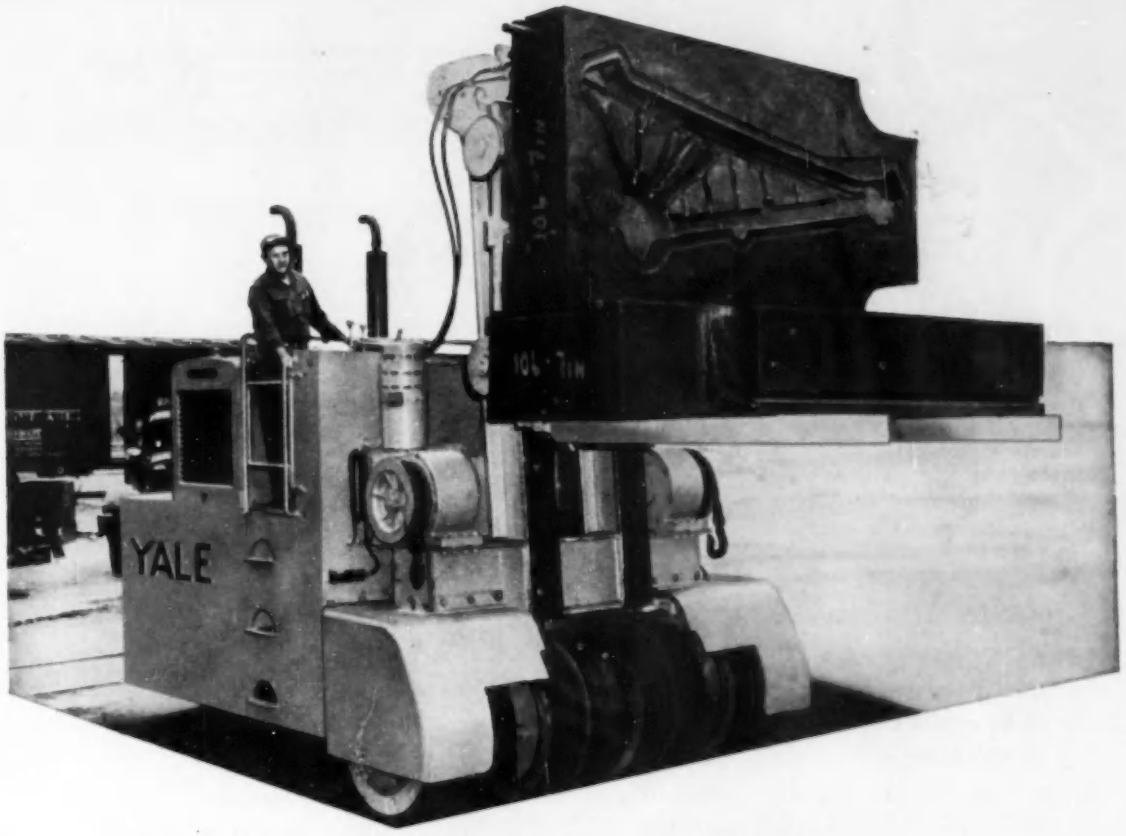
PLAN TO VISIT OUR EXHIBIT AT BOOTH 1213

SEVENTY FIFTH 1880 BULLARD 1955 ANNIVERSARY

WE INVITE YOUR INQUIRIES — CALL OR WRITE YOUR NEAREST BULLARD SALES OFFICE, DISTRIBUTOR

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT



Mammoth dies no match for 80,000 lb. Yale Electric Truck

EXCLUSIVE FEATURES OF ALL YALE TRUCKS OFFER FASTER HANDLING IN AUTOMOBILE PLANTS . . . CUT HIDDEN HANDLING COSTS FOR EXTRA SAVINGS.

YALE industrial trucks meet *every* handling need—give you *more* for your truck dollars at the same time! For heavy jobs—such as handling multi-ton dies quickly, surely—or for routine materials handling in every phase of automobile production, YALE makes a complete line of Electric and Gas Trucks...with exclusive features that (1) cut direct handling costs more; (2) cut *hidden* costs, too, by protecting operators from handling shocks which cause fatigue, impair efficiency.

YALE Gas and Electric Truck exclusives: hypoid gears, inclined king pins, rolled lift channels, spline drive shaft—*plus* famous Fluid Coupling on YALE Gas Trucks. Whether Gas or Electric, you'll find that YALE Industrial Trucks provide smoother operation, easier handling—with minimum downtime. Get full facts today!

YALE* **INDUSTRIAL LIFT TRUCKS AND HOISTS**

*REG. U. S. PAT. OFF.

Gas, Electric, Diesel & LP-Gas Industrial Trucks • Worksavers Warehousers • Hand Trucks • Hand & Electric Hoists

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The YALE & TOWNE Manufacturing Co., Dept. 77
Roosevelt Boulevard, Philadelphia 15, Penna.
Please send complete information on YALE Trucks:
☐ Electric ☐ Gas

Company_____

Name_____ Title_____

Street_____ City_____ State_____

In Canada, write: The Yale & Towne Manufacturing Co.
St. Catharines, Ontario, Canada

This is the tenth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Chromium and Its Effects in Alloy Steels

As previously pointed out in this series, the elements that together make up an alloy steel work both singly and collectively. In a sense they are like the components of a machine, each having its job to do, yet each working with other components to achieve an overall result.

An earlier discussion was devoted to the functions of nickel. In this one we shall outline briefly some of the purposes of chromium, another of the fundamental alloying elements.

Chromium is a versatile agent. Among other things, it fosters depth-hardenability, improves surface resistance to abrasion and wear, and promotes carburization. Of the common alloying elements, chromium ranks near the top in hardenability. This property tends to make high-chromium steels relatively air-hardening; hence it is valuable in applications where, for one reason or another, liquid quenches are undesirable.

Chromium steels are relatively stable at high temperatures and are often used where resistance to heat is important. Moreover, the presence of chromium is a vital factor in helping to retard or prevent corrosion.

The uses of chromium steels are many and varied. Among the more familiar items that often contain chromium are hand tools, gears, springs, turbine wheels, ball and roller bearings, forged shafts and rotors, etc. There are of course numerous others; virtually no list would be all-inclusive.

One of the most useful of the alloys, chromium has been the subject of long study by Bethlehem metallurgists. These technicians have a thorough working knowledge of its effects in various types of analyses. Whenever you have a problem involving chromium steels, or would like to know more about the subject in general, by all means communicate with the Bethlehem staff. Our men will come to your office or plant at any time. You will find them co-operative and helpful.

And please remember, too, that Bethlehem makes the full line of AISI standard steels, as well as special-analysis steels and all carbon grades. Your inquiries will receive our most careful attention.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

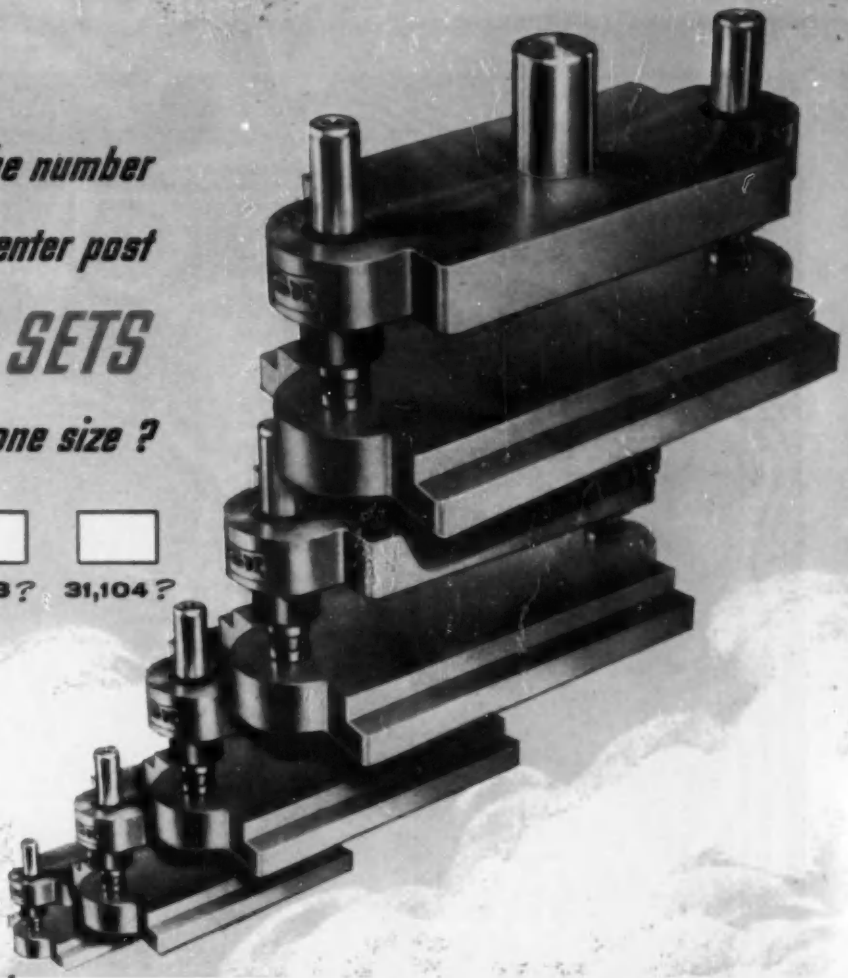
BETHLEHEM STEEL

BETHLEHEM STEEL

can you guess the number of different center post

DANLY DIE SETS

in stock–in just one size ?



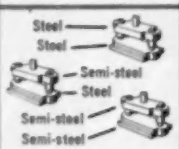
67 ? 575 ? 1433 ? 31,104 ?

3 different punch holder thicknesses

3 different die shoe thicknesses

6 shank size variations

4 bushing type variations



3 different material combinations

16 guide post lengths in each of 3 different styles to choose from

If you guessed 31,104 different standard center post Danly Die Sets in just one size . . . then you were right! Simply multiply together all of the variation possibilities shown in a Danly Catalog for a 12x12 standard center post precision Danly Die Set, and you'll get this remarkable figure. Even more remarkable is the fact that *all* of these variations are cataloged and *stocked* in every Danly Branch.

Just how does this benefit you? This almost unlimited variety of Standard Danly Die Sets in stock at your Danly Branch is your assurance that you can always get the die set you want . . . *when* you want it. That's important in saving tooling time. So remember, when you want the best in die sets—*fast*—the place to call is your local Danly Branch.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

Choose the Danly Branch closest to you:

BUFFALO 7
1807 Elmwood Avenue

CHICAGO 50
2100 S. Laramie Avenue

CLEVELAND 14
1550 East 33rd Street

DAYTON 7
3196 Delphos Avenue

DETROIT 16
1549 Temple Avenue

GRAND RAPIDS
113 Michigan Street, N.W.

INDIANAPOLIS 4
5 West 10th Street

LONG ISLAND CITY 1
47-28 37th Street

LOS ANGELES 54
Ducommun Metals & Supply Co.,
4890 South Alameda

MILWAUKEE 2
111 E. Wisconsin Avenue

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511 W. Courtland Street

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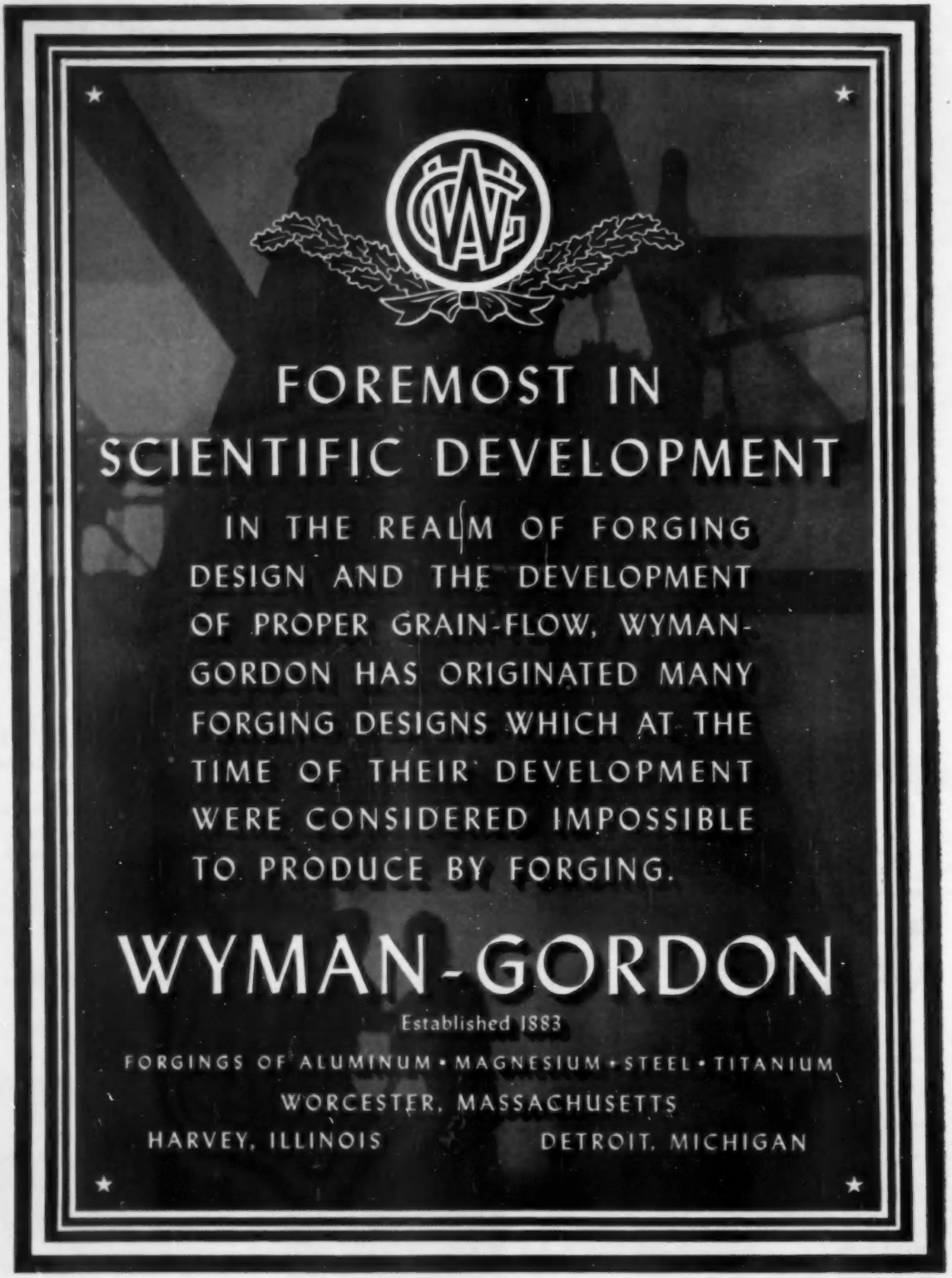
33 Rutter Street

ST. LOUIS 8
3740 Washington Blvd.

SYRACUSE 4
2005 West Genesee Street

DANLY

DIE SETS . . .
STANDARD OR SPECIAL
DIEMAKERS SUPPLIES


FOREMOST IN
SCIENTIFIC DEVELOPMENT
IN THE REALM OF FORGING DESIGN AND THE DEVELOPMENT OF PROPER GRAIN-FLOW, WYMAN-GORDON HAS ORIGINATED MANY FORGING DESIGNS WHICH AT THE TIME OF THEIR DEVELOPMENT WERE CONSIDERED IMPOSSIBLE TO PRODUCE BY FORGING.
WYMAN-GORDON
Established 1883
FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
WORCESTER, MASSACHUSETTS
HARVEY, ILLINOIS
DETROIT, MICHIGAN

Diesel fuel additive

to relieve filter-plugging and injector-sticking problems

In an effort to reduce operating costs, the railroads have recently done considerable work with catalytic-cracked and blends of cat-cracked and straight-run diesel fuels.

Engine performance problems

With the cooperation of the refiners, much progress has been made by the railroads in the efficient use of these fuels. However, there are a number of problems inherent in such a change of fuels—some of them having a direct bearing on the performance of diesel engines.

Filter-plugging—which is likely to result in injector-sticking—has been one of these problems.

To solve it, many refiners are now using a Du Pont additive, FOA-2, to stabilize cracked distillates and overcome incompatibility between blends of cracked and straight-run stocks. Many of the leading railroads are reporting excellent results with No. 2 fuel oils containing FOA-2.

Good filterability

Du Pont FOA-2 is a dispersant as well as a stabilizer. And because of its excellent dispersant action, it improves the filterability of diesel fuels. In this way, it helps to *eliminate most injector-sticking and filter-plugging problems.*

In addition, being an ashless, nonmetallic additive, Du Pont FOA-2 does not contribute to the exhaust stack sparking problem. It is economical, too, since it is effective in low concentrations.

Developing new additives for improved fuel and lubricant performance is a continuing project of the Du Pont Petroleum Laboratory. For more complete information on Du Pont FOA-2 and other new Du Pont additives, address your request to any of our regional offices listed below.

DU PONT

Reg. U.S. Pat. Off.

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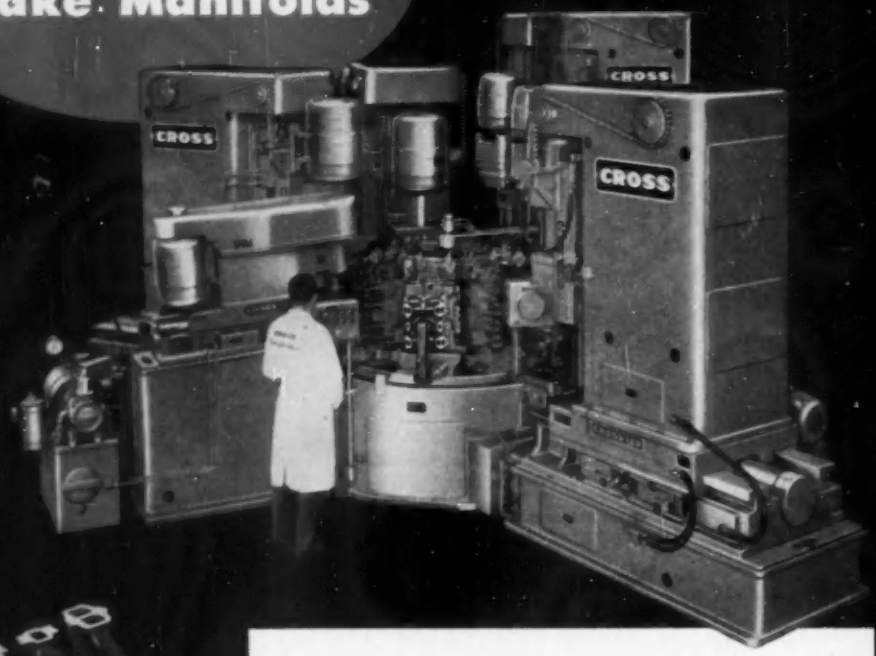
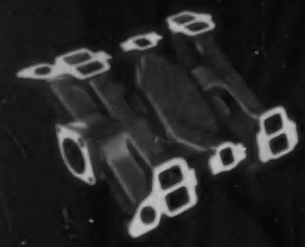
Mills and Drills 2 and 4 Barrel Intake Manifolds

Another Special by Cross





- ★ Rough and finish mills mounting faces; mills, drills and chamfers water outlet pad.
- ★ 145 pieces per hour at 100% efficiency.
- ★ 7 stations: 1 loading, 4 milling, 1 drilling and 1 chamfering.
- ★ Hydraulic power clamping for work holding fixtures.
- ★ Automatic retraction for milling cutters.
- ★ Cross-Drive for milling cutters.
- ★ Pre-set tooling throughout.
- ★ Gravity operated cam clamping for indexing table.
- ★ Other features: Hardened and ground ways; hydraulic feed and rapid traverse; complete interchangeability of all standard and special parts for easy maintenance; Construction to J.I.C. standards.

See us in Booth No. 1118 at the Machine Tool Show

Established 1898

THE CROSS CO.

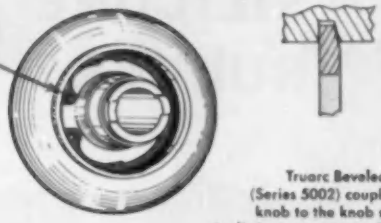
DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Waldes Truarc Retaining Rings Eliminate Machining— Provide Stronger Assembly, Greater Accuracy

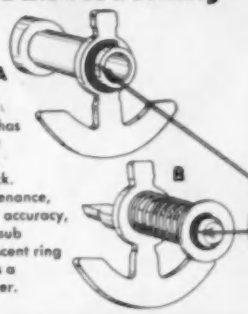
The American Hardware Corp., New Britain, Conn., uses 4 different types of Waldes Truarc Retaining Rings in the original design of these famous Corbin and Russwin Heavy Duty Cylindrical Locks. Truarc rings improve product performance, eliminate rejects, and cut labor costs.

Knob Sub Assembly



Truarc Beveled Ring (Series 5002) couples the knob to the knob shank. It eliminates two tapped holes and two screws, provides stronger assembly and greater accuracy. Beveled ring takes up end play rigidly.

Spindle Sub Assembly



Spindle sub assembly "A" has two Waldes Truarc crescent rings (Series 5103) used as locating flanges for rollback. This saves labor and maintenance, improves performance and accuracy, eliminates rejects. Spindle sub assembly "B" uses one crescent ring as a spring retainer and as a locating shoulder for washer.

Cylinder Sub Assembly

Knob unlocking mechanism uses one Truarc E-ring (Series 5133) as a spring retainer and one inverted ring (Series 5108) for retaining the cylinder plug. Rings are re-usable in the event of disassembly for maintenance. Rejects are eliminated.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U.S.A. and Canada.

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Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

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Business Address_____
City_____ Zone____ State_____

AT 977

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

How can you benefit from the AMAZING "COME-BACK" of G-E SILICONE RUBBER?

Amazing recovery from compression is one of the most useful characteristics of General Electric silicone rubber. In fact, Class 300 silicone rubber has more "come-back" over a wider temperature range than any known rubber! That's why designers now use it where compression is a factor. They know that O-rings and gaskets made of Class 300 silicone rubber *resist compression set*—give *more positive* sealing action for better performance!

Where can YOU use G-E silicone rubber? There's a kind for almost every requirement, classified according to dominant property for easy selection and specification. For example: Class 500 offers flexibility *at 120 F below zero!* Class 700 provides serviceability *up to 600 F!* Which class of G-E silicone rubber is best for *you?*

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Outstanding resistance to extreme temperatures

Superior resistance to compression set

Dielectric strength stable at high temperatures

Unequalled resistance to aging, ozone, weathering

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Please send me technical data on G-E silicone rubber, including a free "Lightning Selector" and up-to-date list of fabricators. I am chiefly interested in:

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ALCOA 'S Die Shop

(LAFAYETTE, INDIANA)

Alcoa's dies for extruding aluminum must have precision and flawless machine work. To insure precision in facing their extrusion dies, Alcoa's die shop at Lafayette, Indiana, makes use of DELPARK filtration on a Blanchard grinder to remove grindings from the coolant.

DELPARK offers you many advantages through coolant filtration. Greater accuracy and quality, longer tool life, increased machine efficiency and reduced maintenance costs often result in yearly savings which are greater than the original filter cost.
Let a field engineer show you how DELPARK filtration can increase savings for you. *Write today for more information.*

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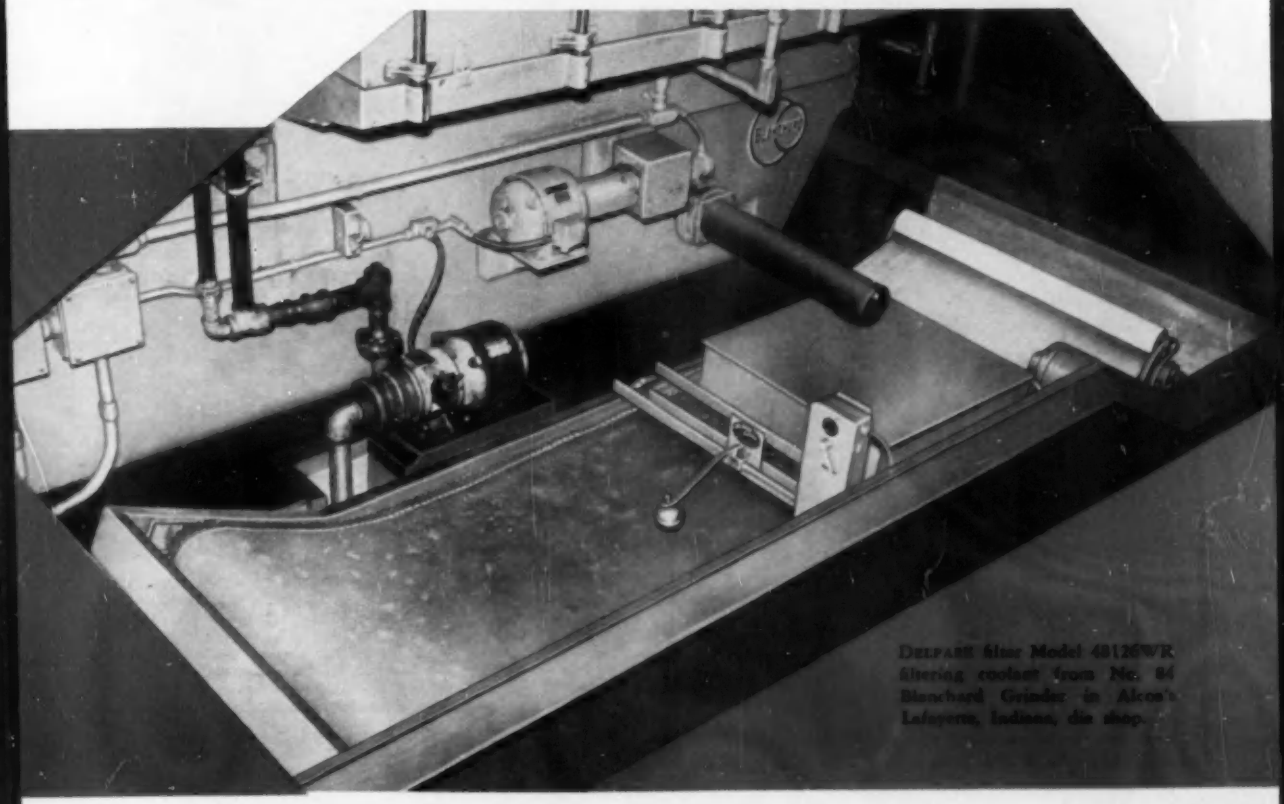
ON REQUEST!

If your grinders are using unfiltered coolant, you're wasting money. DELPARK's bulletin on coolant filtration can help you increase production and machine efficiency.

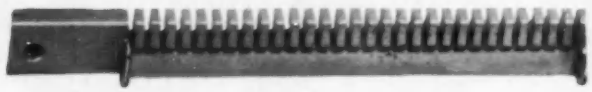
IT'S FREE . . . *write today for your copy.*



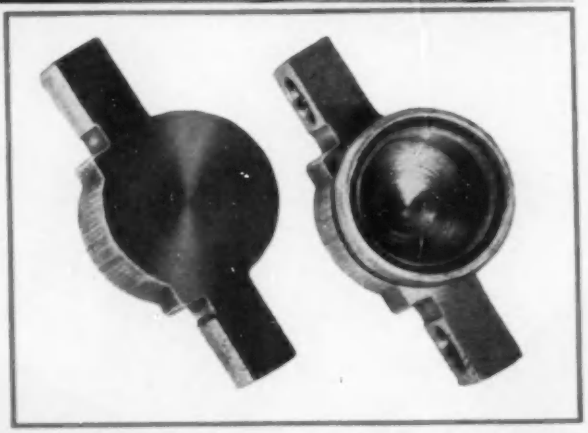
DELPARK filter Model 48126WR filtering coolant from No. 84 Blanchard Grinder in Alcoa's Lafayette, Indiana, die shop.

INDUSTRIAL FILTRATION COMPANY, 19 INDUSTRIAL AVENUE, LEBANON, INDIANA

Here's a to spark



Remington Rand makes this quality steel part at less cost from Republic cold drawn special sections



THE AUTOMOTIVE INDUSTRY is a large user of Republic Special Sections. This wing bushing, above right, for a universal joint is made from the special shape shown above left.

REPUBLIC STEEL CORPORATION
3106 East 45th Street
Cleveland 27, Ohio

Please send more information on:

☐ Cold Drawn Special Sections ☐ "Nylok" Nuts
☐ High Strength Steels ☐ Tool Steel Warehouse Service

Name_____ Title_____

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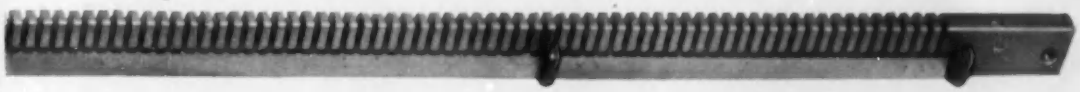
cost-saving idea your imagination



The part is the margin rack for Remington's new Office-Riter. It is produced at less cost because much of the machining is eliminated. The production men at Remington Rand put it this way, "To produce this part from raw bar stock would require costly machining and would result in an inferior part." So they use Republic Cold Drawn Special Sections preformed to the predominating cross section of the part.

If you produce or design steel parts and are interested in reducing costs, you'll want to know more about cold drawn special sections supplied by Republic's Union Drawn Division. You'll want to know more about these advantages.

1. Flexibility in design is almost limitless.
2. Shapes obtainable in one piece replace costly assemblies.
3. Special sections simplify built-up, interlocking, or associated parts.
4. Benefits from cold drawing are higher strength, greater hardness, a bright smooth finish that rarely requires further machining.

Sections are made to your specifications in all grades of carbon, alloy and stainless steel. While large tonnage requirements are not necessary, they do result in greater economies. We can supply cold drawn special sections in large or small quantities to meet your requirements.

Give you an idea? Send us samples or blueprints of your parts. We will tell you promptly and impartially whether the nature of your parts would make the use of Republic Cold Drawn Special Sections efficient and economical. Mail the coupon for more information.

REPUBLIC STEEL

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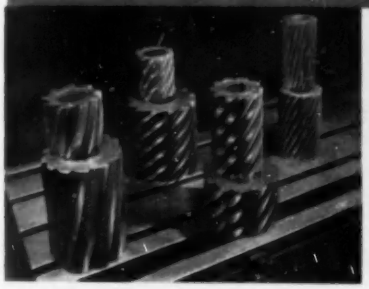
HERE ARE MORE COST-SAVING IDEAS FROM REPUBLIC



SAVE SPACE AND INVENTORY COSTS on steels for tools, like these milling cutters, by using Republic's Tool Steel Warehouse Service. Warehouses in Detroit and Cleveland carry complete stocks of tool steels, automotive die steels, precision-ground flat stock, cold-drawn shank steel. A phone call brings what you need in a hurry, whether it's one piece or a truckload. Questions on steels, dies, heat treating and machining are answered expertly and promptly by our tool steel metallurgists.

HIGH DUCTILITY, PLUS PROVED WEIGHT SAVING, may make you want to know more about Republic High Strength Steels. Their application to various products permits weight reduction up to 25%. And when your product is designed and engineered all the way for high strength steel, weight reduction up to 50% is possible. Republic High Strength Steels are ideally suited for use in structural parts for earth-moving equipment, truck and gasoline trailers, railroad uses. They resist corrosion; extend equipment life by standing up to rough usage.

REPUBLIC "NYLOK" NUTS HELP REDUCE ASSEMBLY COSTS by eliminating lock washers, slotted nuts and cotter keys. Yet they assure positive locking in any position, even under severe vibration. Assembly is speeded, too, because either end of the nut is up. No special tools, lubricants or techniques are needed to start them. "Nylok" Nuts can be backed off for maintenance of equipment and reused. Investigate their use for your product. "Nylok" Nuts are only one of more than 20,000 types and sizes of fasteners made by Republic.

Available as rough forgings, rough machined or finish machined . . . in a wide variety of alloys.

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Resistance Welding Products

In addition to seam welding wheels, Mallory offers a full line of electrodes, holders, dies, forgings, castings and rod and bar stock . . . in a choice of alloys developed over more than 20 years of pioneering experience in resistance welding. All are described in our new catalog. Write for your copy, or get one from your nearby Mallory distributor.

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

For many years, all Mallory seam welding wheels have been produced by a cold forging technique, especially developed by Mallory metallurgists to impart the highest physical properties. The high standards of performance of these wheels . . . long wheel life, infrequent need for dressing, consistently high strength welds . . . make them the best buy for welding applications where requirements are severe.

Now, for jobs whose requirements are less exacting, Mallory offers a new line of wheels in Mallory 3 Metal produced *without* the cold forging operation . . . at correspondingly lower prices.

Both lines are available in a wide range of sizes, as rough forgings, rough machined or finish machined parts.

Your own application is the deciding factor. Mallory engineers will be glad to help you select the wheels that will provide the best combination of performance and economy for your specific job. Write today for recommendations on your own problem.

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HOW TO COMPLETE THE JOB *Faster...*

AND STILL GET MORE ACCURATE PARTS!

When you tool up jobs this way on an ACME-GRIDLEY MULTIPLE SPINDLE CHUCKING AUTOMATIC, you often *complete* the parts in one setup—and they are more accurate and uniform because rehandling and rechucking for second operation work is eliminated.

And the corollary to this is that man hours are released for other work—and space formerly needed for second operation work is saved.

On this cast iron housing, all 17 operations were performed simultaneously, with a *single completely carbide-tooled setup*—on an Acme-Gridley 8-inch, 8-spindle chucker. And because the work on all spindles is always done within the time required for the longest single cut, the floor-to-floor time on this job was at the rate of 61 *completed* pieces per hour.

This is where multiple spindle *planning* pays off.

JOB FACTS

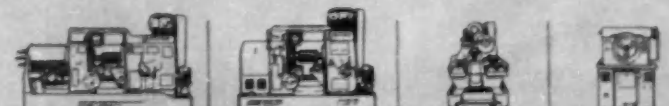
- **Roughing and finishing operations performed on this SAE 120-121 Cast Iron Housing include multiple recessing shown in sketch. The three grooves were rough recessed in one station and finished recessed together with front and rear counterbore in another position.**
- **Three rough boring passes were finish-reamed with accelerated reaming attachment in one pass.**
- **Carbide tooling used throughout.**

And this is where the vast experience of National Acme tooling engineers (they have helped plan the cost-reduction of more than 300,000 jobs) wins and holds preference for Acme-Gridley bar and chucking automatics—in hundreds of shops.

These engineers will give you sound advice; unbiased advice in both job setup and equipment—from the world's only manufacturer of a *complete line* of multiple spindle bar and chucking automatics and fully automatic turret lathes.

Send for Catalog CM-51 or ask for our recommendations

See us at The Machine Tool Show, September 6 to 17. Booth Numbers 324 and 705



OUR JOB: to provide the *Right Machine* for YOUR JOB

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

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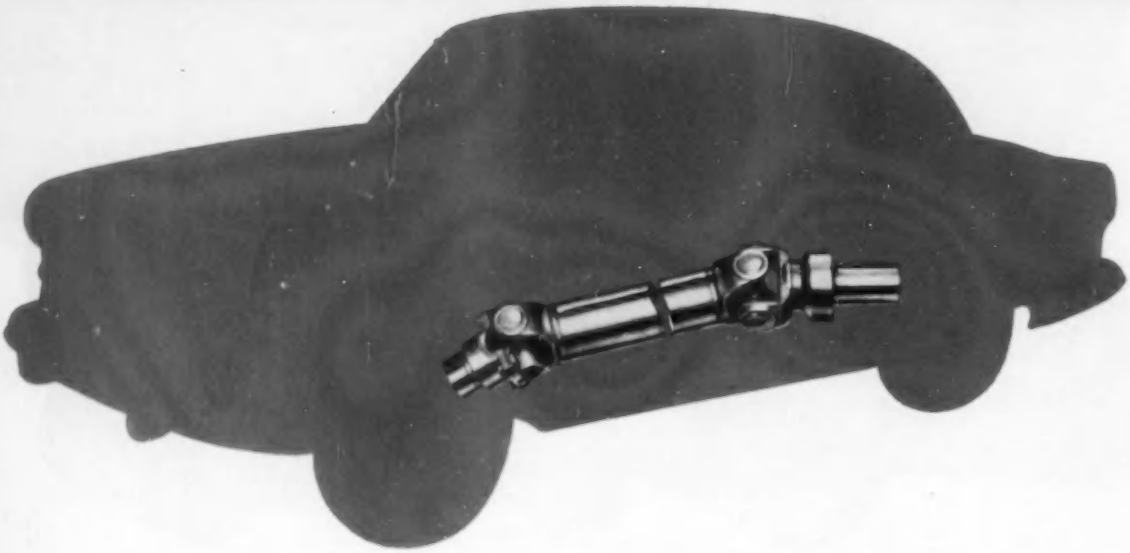

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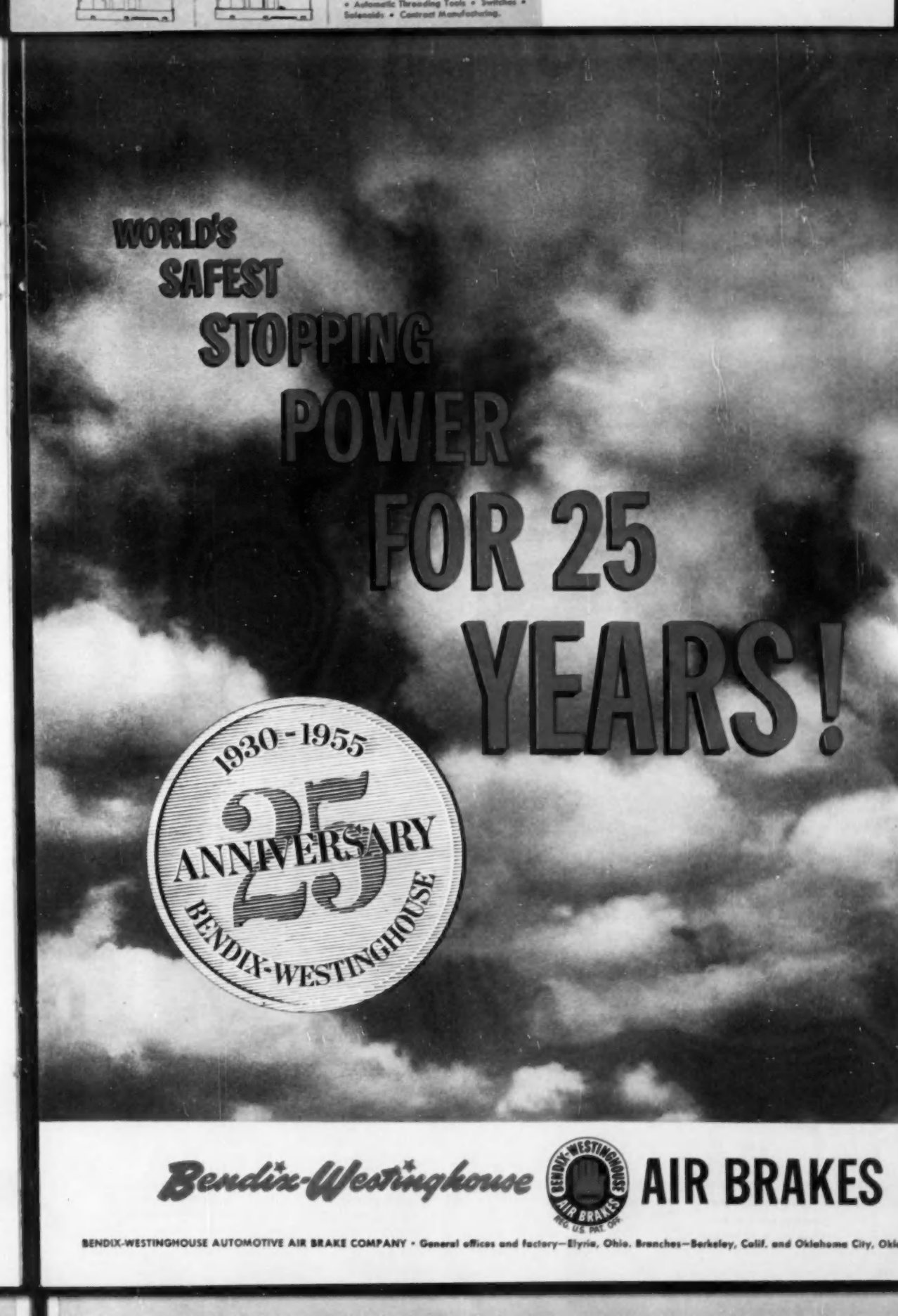
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HOW R/M ENGINEERING SETS

R/M
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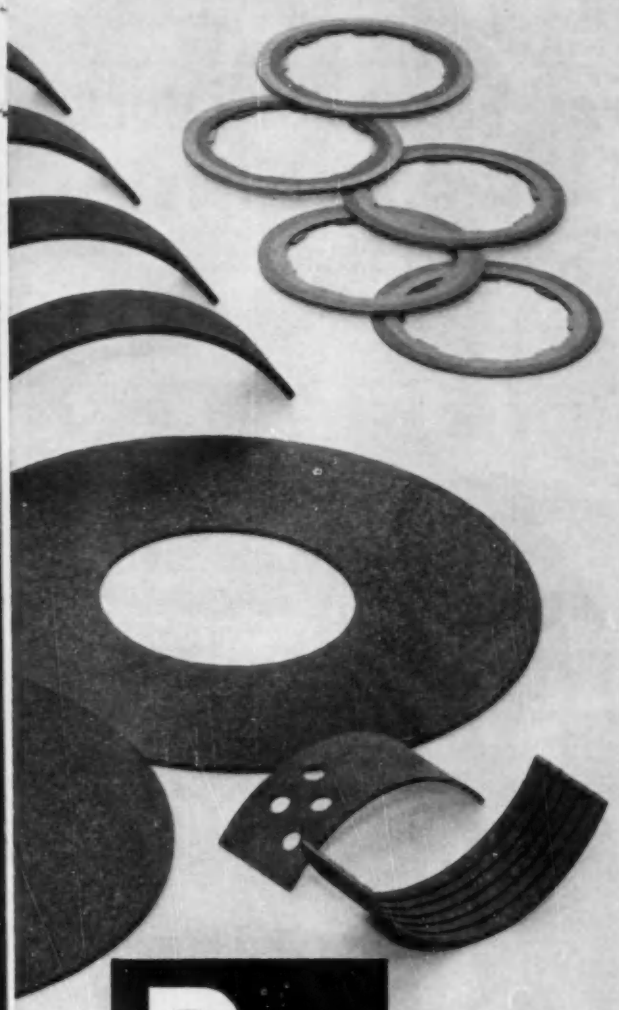
Illustrated above are just a few of the friction parts made by R/M for operation in oil. The wide variety of sizes and shapes suggests the tremendous scope of R/M experience in solving specialized application problems in this field.

THE RECORD OF "FIRSTS" IN FRICTION MATERIAL DEVELOPMENT SHOWS WHY R/M IS FIRST IN FRICTION

FIRST Woven Brake Lining • FIRST Asbestos Brake Lining • FIRST Ground Wearing Surface • FIRST Zinc Alloy Wire Brake Lining • FIRST Pre-Treated Yarns • FIRST Extruded Pulp Brake Lining • FIRST Flexible Pulp Brake Lining in Rolls • FIRST Dry Process Brake Lining • FIRST Semi-Metallic Brake Lining • FIRST Bonded-to-Metal Brake Lining • FIRST Woven Clutch Facings • FIRST Molded Asbestos Clutch Facings for Clutches Operating in Oil FIRST Endless Woven Clutch Facings • FIRST Pre-Treated Clutch Facings • FIRST Bonded-to-Metal Clutch Facings

THE PACE IN FRICTION MATERIAL DEVELOPMENT



FRICTION MATERIALS FOR OPERATION IN OIL

Concerned with friction parts for use in oil? R/M has made more friction material for wet operation than all other manufacturers combined.

For more than 50 years Raybestos-Manhattan, the world's largest maker of friction materials, has set the pace in developing friction material for oil use.

R/M developed the first molded asbestos facings for clutches operating in oil. R/M was the first to develop a dynamometer for testing friction materials in oil operation. And R/M was the first to chart the properties of friction material operating in oil at speeds up to 18,000 rpm.

Today, every model of full or semi-automatic transmission for passenger cars (many trucks, too) is equipped with one or more R/M friction products.

Constantly researching and testing the effects of such factors as oil viscosity, types of grooves, and temperature variations—as well as pressures and operating speeds—on coefficient of friction in oil, Raybestos-Manhattan has found precise answers to problems concerning oil operation.

Whether your design requirements can best be solved by resilient, rigid molded, semi-metallic or sintered metal friction parts, R/M can supply the exact material or combination you need.

R/M Offers the Widest Range of Friction Materials

Unlike most other manufacturers, Raybestos-Manhattan works with *all* kinds of friction material. And R/M can offer the O.E.M. the widest range of such materials in the industry. This means that you can be sure of completely unbiased advice on which materials will best meet your requirements when you consult with an R/M engineer.

When you call in R/M on a brake or clutch problem, seven great plants—with their research and testing laboratories—pool all their skills and experience to find the most practical, most economical answer. To fit a highly specific condition R/M will either develop friction material for your purpose, or, if more economical for you, suggest how you can redesign to make effective use of an R/M material already available.

If you're looking for friction materials—for either wet or dry operation—with greater output and greater durability, call in an R/M representative now. All of R/M's experience in friction is as near as your telephone.

Write for your free copy of R/M Bulletin No. 500. Its 44 pages are loaded with practical design and engineering data on all R/M friction materials.

R/M
FIRST IN FRICTION

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Young Heat Transfer News

YOUNG RADIATOR COMPANY, RACINE, WIS.

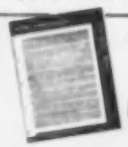
Allis-Chalmers *SPECIFIES* Young Radiators for models CA and WD-45 Tractors

Radiator type and evaporative type cooling equipment using dry air as the cooling medium should be designed to operate under the DRY BULB air temperatures to be expected during the summer in the locality where the equipment is to operate. Equipment using cooling effect due to water evaporation is designed to operate under the WET BULB air temperatures to be expected.

For proper design, it is not satisfactory to use either the maximum air temperature, nor the average air temperature. Use of the maximum air temperature for design would result in the selection of cooling equipment too large to be economical, since it would be fully loaded only under the most extreme temperature conditions. Use of average temperature for design purposes would result in selection of equipment too small to handle the cooling load during a great portion of the operating time. It is necessary, therefore, to use some figure between maximum and average air temperatures.

The Young Radiator Company has prepared and offers to engineers engaged in the design and application of radiator type and evaporative type cooling equipment, data taken from the results of five years of summer records in the United States. This data may be used and considered as applying to an average year.

For a copy of this data, write for Bulletin 654, Young Radiator Company, Racine, Wisconsin.



WRITE FOR FREE DESIGN TEMPERATURE BULLETIN OF THE UNITED STATES

Helpful four-page Bulletin briefly discusses atmospheric cooling equipment design temperatures for the United States. Wet and dry bulb maps are fully illustrated with isothermal lines. Write Young Radiator Company, Dept. 105-G, Racine, Wisconsin.

Drawn Tank Radiators Meet All Tractor Cooling Loads

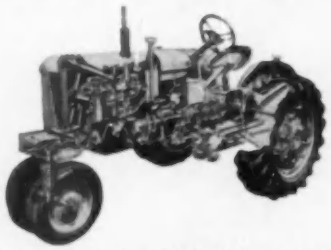
Allis-Chalmers Manufacturing Company, West Allis, Wisconsin, uses Young Radiator Company drawn tank Radiators on two powerful tractor models.

Built to withstand the constant strain and stress put upon tractors, these Young units must cope with high internal water impact pressures due to sudden starting and stopping.

To overcome these and other torsional stresses and long term vibrations, full wrap-around type terne plate side members secure tanks, headers and core as one piece. Brass top and bottom tanks are formed as one piece and have die-formed beads for reinforcement. Fabricated brass inlet with maximum flow area provides minimum resistance to coolant circulation.

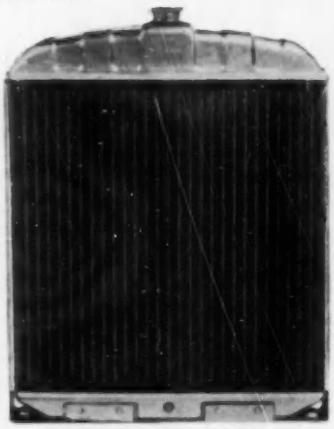
This Radiator also features Young patented double-grip, two-way headers with lapped joint solder sealed to tanks as a permanent, leak-proof assembly. Fully soldered double-lockseam tubes with corrugated fins makes for strength and maximum air turbulence and greater heat transfer.

For further details, write Dept. 295-D, Young Radiator Company, Racine, Wisconsin.



Cross-sectional view of Allis-Chalmers Model WD-45 Tractor with Young Radiator.

View of Allis-Chalmers CA Tractor and forage harvester making grass silage.



Young Radiator Company drawn tank Radiator used on Allis-Chalmers Model CA Tractor.

Young RADIATOR COMPANY

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Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

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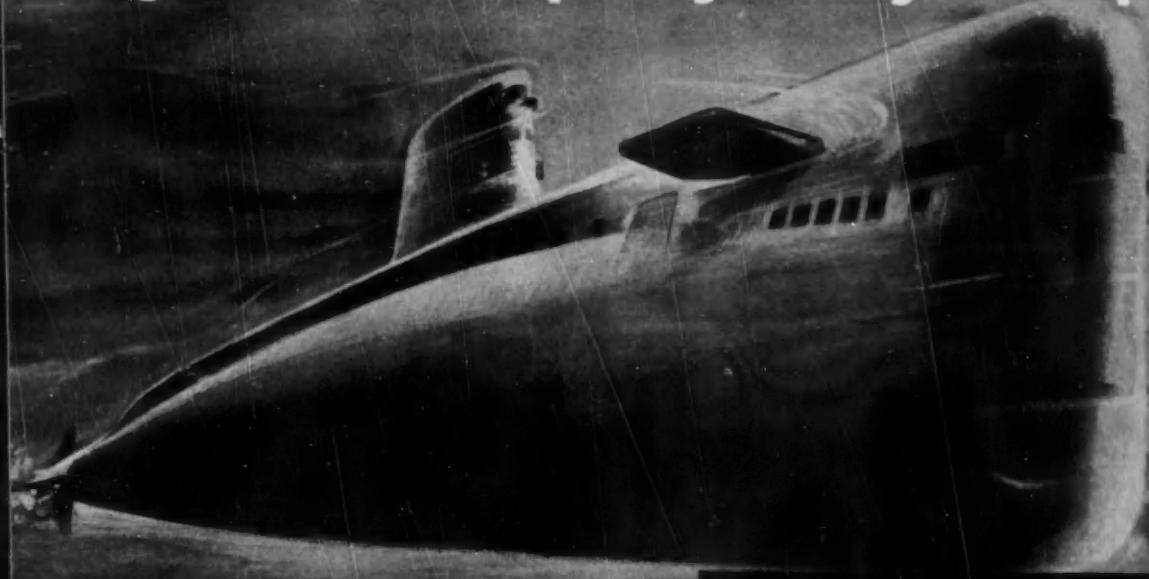

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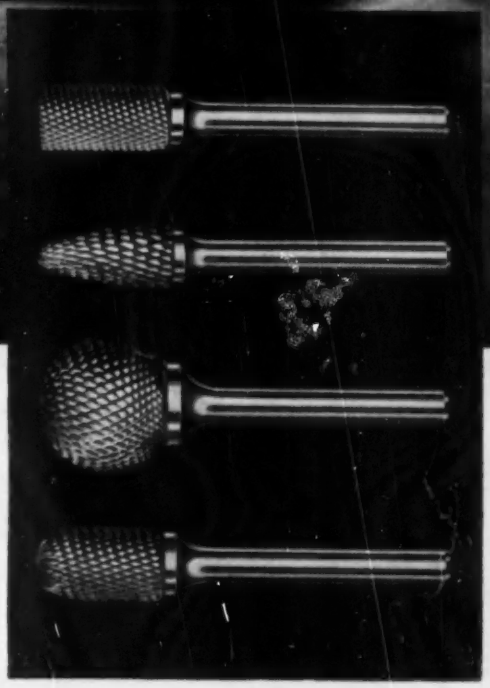

Able to cruise around the world at comparatively high speeds without surfacing, the atomic-powered submarine, USS Nautilus, is a giant stride into the future by American science and industry.

Throughout construction of this most advanced of all underseas craft by Electric Boat Division of General Dynamics Corp., P&W Kellerflex Burs — representing the ultimate advances in bur technology — were used exclusively. And aboard the Nautilus — where each part is weighed to the ounce and only the most essential equipment is carried — it is also significant that P&W Kellerflex Burs are included in the tool kits.

Yes, wherever only the finest will do, you'll find Pratt & Whitney Kellerflex Carbide Burs. For complete information, write on your Company letterhead for Circular No. 564.

SEE THEM AT BOOTH 1219

THE MACHINE TOOL SHOW

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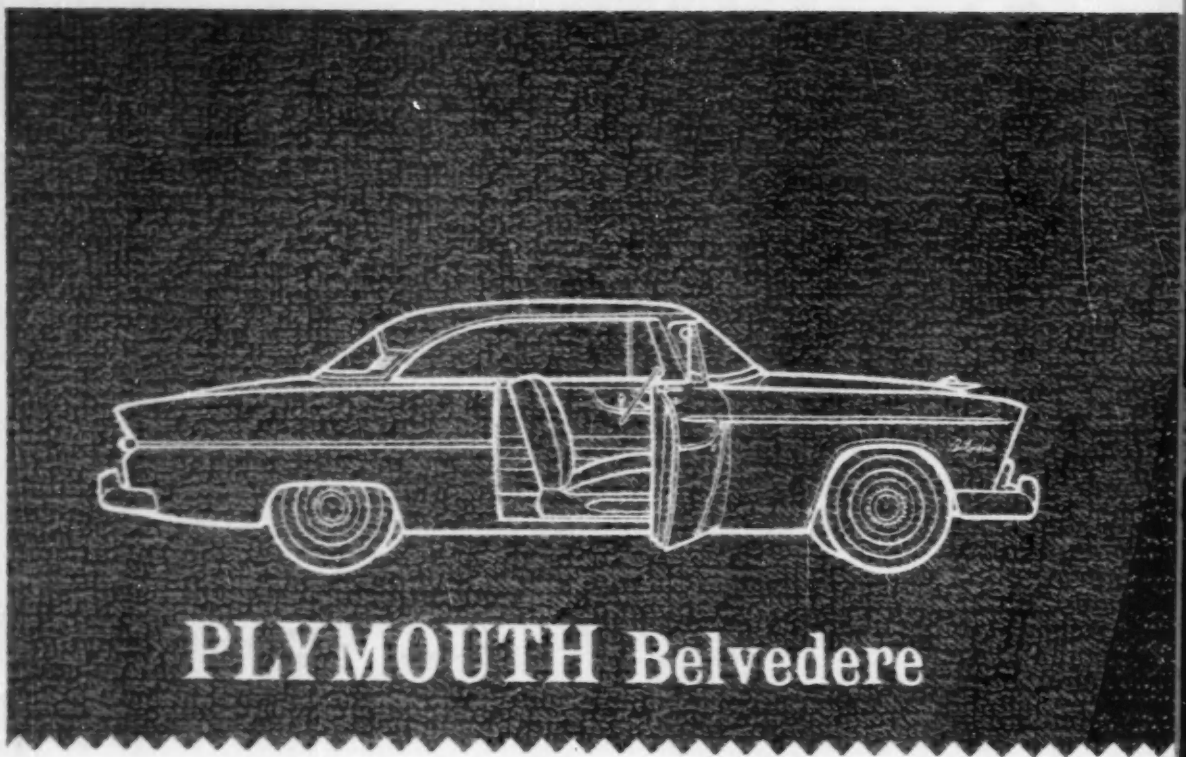
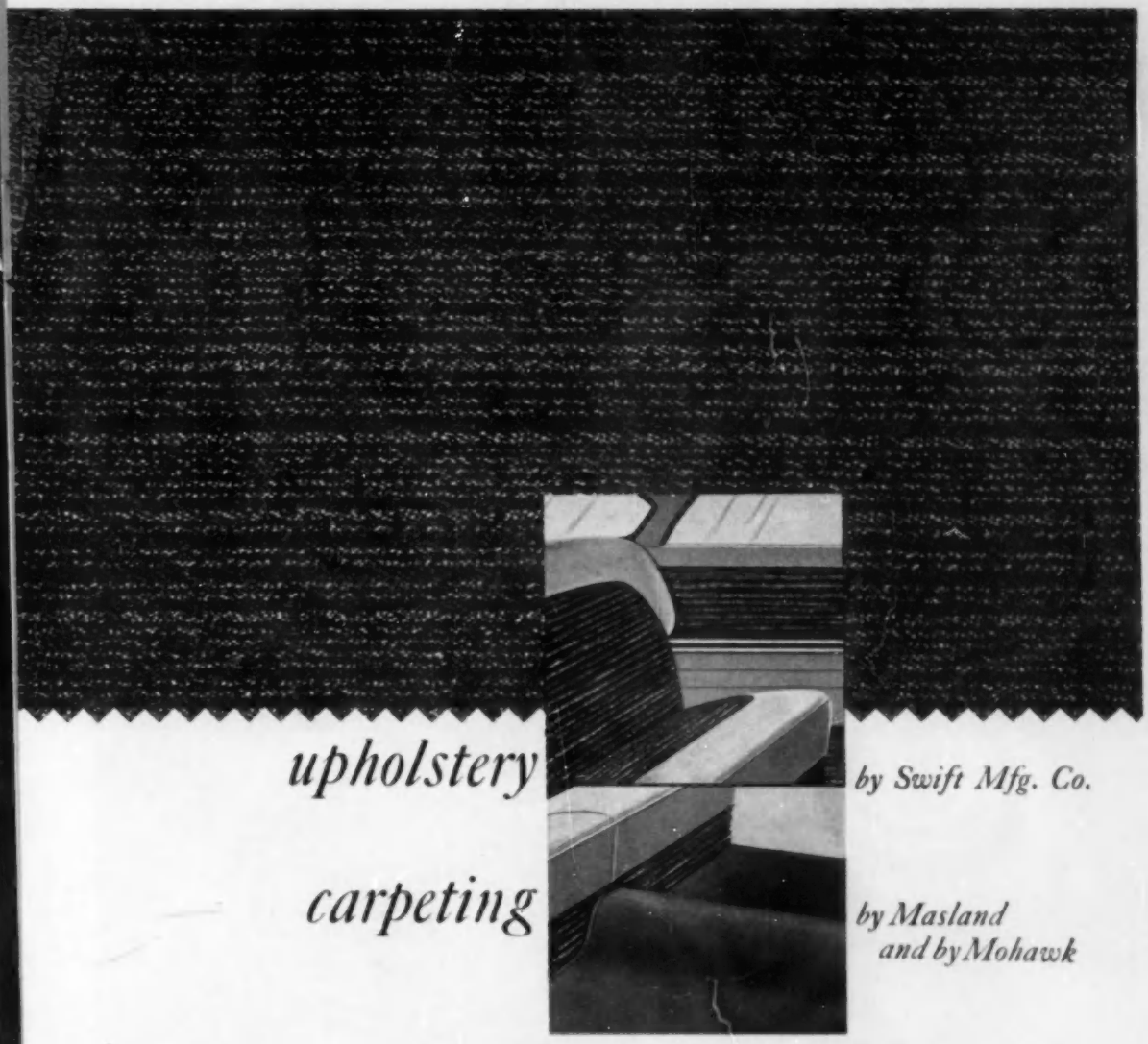


blends



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At a time of increasing emphasis on car interiors, IRC is proud that the biggest names in the automotive industry are featuring interior trim blended fabrics using the NEW Nylon Staple—introduced less than a year ago! Leading Mills report it is a better nylon staple, for it has seven new and distinctive features capable of producing new and better effects.

• MORE RESILIENCY *with less* **CRUSHABILITY • GREATER STRENGTH**
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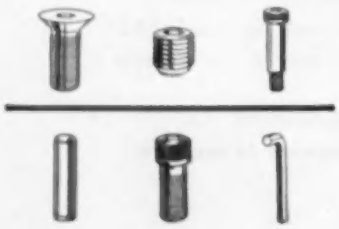
UNBRAKO AT WORK



BUTTONING UP THE JOB PROPERLY. UNBRAKO Button Head Socket Screws, of course, provide a smooth, streamlined surface. They are strong, too. But equally important is the ease with which they can be inserted and withdrawn without marring the socket of the screw or the surface of the assembly. For the complete UNBRAKO story, see your authorized industrial distributor. Or write to STANDARD PRESSED STEEL CO., Jenkintown 53, Pa.

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Production Doubled
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TOCCO-METHOD

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with TOCCO* Induction Heating

The experience of The Commercial Shearing and Stamping Company, who use TOCCO for silver-brazing hydraulic cylinder assemblies, is typical of the benefits obtained by America's leading metal-working plants who use TOCCO Induction Heating for brazing, hardening, heat-treating, forging and melting operations.

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Lower Costs with TOCCO

a. Through a reduction in time required for each piece.

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Improved Product with TOCCO

a. Because of better looks and sales appeal.

b. Because distortion is minimized.

c. Because of elimination of field failures due to severe stress pockets.

TOCCO Engineers — can probably find applications in your plant, too, where TOCCO Induction Heating can increase output, cut unit costs and improve your product. Such a survey costs you nothing—and may save you a great deal.

THE OHIO CRANKSHAFT COMPANY

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FOR AUTOMOTIVE EQUIPMENT

From four wheel brakes to the latest development in power braking, Bendix Products Division has demonstrated its unique ability not only to keep pace but *actually to anticipate* the industry's requirements for the latest and most efficient in automotive components.

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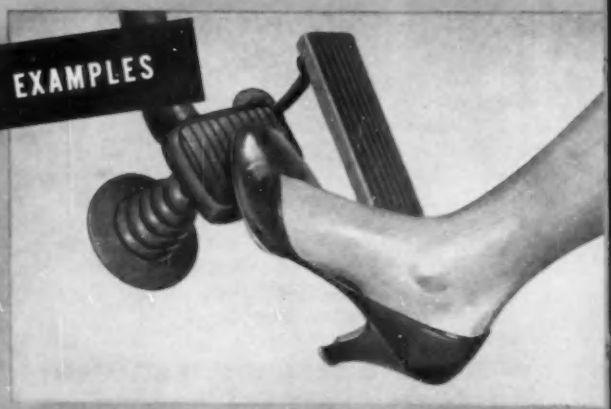
BENDIX LINKAGE TYPE POWER STEERING—Because Bendix* Power Steering is of the linkage type, manufacturers find it especially adaptable for production line installation without extensive engineering changes. Manufacturers can now meet the ever-increasing demand for power steering more efficiently and more economically with Bendix Linkage Type Power Steering.



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High Spots of This Issue

★ Induction Hardening of Axle Shafts at Chrysler

Previous successful experience in the hardening of axle shafts for cars and trucks inspired Chrysler to conclude that they could also be case-hardened by induction heat-treating. This article describes the process and equipment used. Page 48.

★ Budd Saves Time With Plastic Tooling

Dies, jigs, fixtures, and models for the production of automobiles and railcars lend themselves neatly and efficiently to reinforced plastics at The Budd Co. The economies effected in both time and money are appreciable. See Page 52.

★ GM and Ford Pacts Are Viewed Warily by Others

Now that its historic new contracts with Ford and General Motors are history, the UAW-CIO turns its attention to other smaller companies. Their natural concern over the precedents set and other matters are analyzed in this report. Page 56.

★ Machining Operations at Chevrolet V-8 Plant

Interesting sequel to two previous articles on the Chevrolet V-8 engine plant at Flint, Mich., this third part discusses additional machining operations. The equipment used and its functions are described in detail. See Page 58.

★ Highlights of SAE Summer Meeting

Ocean breezes at Atlantic City, N. J., did not cool the ardor of the discussions sparking the annual summer meeting of the SAE last month. Materials, fuels, transmissions, engines, etc., were some of the subjects hashed over. Page 64.

★ 42 New Product Items And Other High Spots, Such As:

Air Force specifications clarified; new turbocharged Diesel; plastic delivery truck body; engine to run year without service; rain erosion on aircraft surfaces; and Le Mans race.

Complete Table of Contents, Page 3
Automotive and Aviation News, Page 33

AUTOMOTIVE INDUSTRIES COVERS
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES • BODIES • TRAILERS • ROAD MACHINERY • FARM MACHINERY • PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT • SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT
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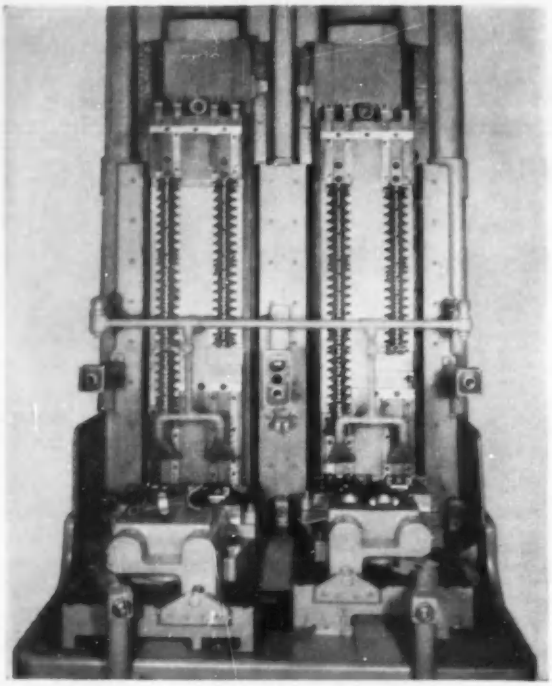
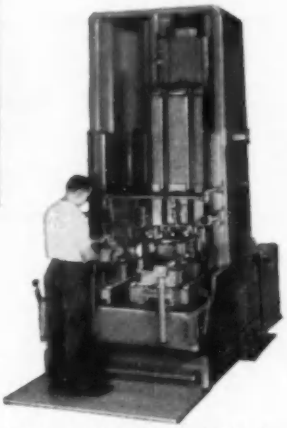
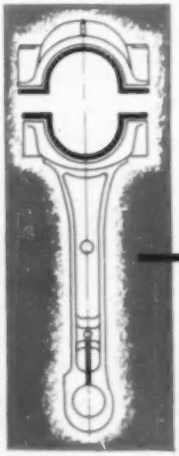


Complete Production Package *by Cincinnati*

Hydro-Broaches 290 sets of Parts per Hour



CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach. Write for Catalog No. M-1848 which contains complete engineering specifications.



Drawing of connecting rod and cap broached on the All-Cincinnati equipment illustrated here:

Part name	Connecting rod and cap
Material	Steel forging
Operation	Broach half bore and parting face
Depth of cut	3/32"
Broaching speed	34 feet per minute
Production	580 parts (290 sets) per hour
Machine	CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach

Caps and connecting rods for automotive engines are usually required in large volume, and those broached on the equipment illustrated here are no exception. To meet the production requirements of 580 parts per hour (290 sets) Cincinnati Application Engineers tooled up a No. 10-66 Duplex Vertical Hydro-Broach with two labor-aiding mechanically actuated automatic fixtures. Each holds one pair of parts—a cap and a rod. Clamping and unclamping are automatic . . . the operator is concerned only with positioning and removing the work. ¶ Several Hydro-Broach features contribute to the uniformly high production required for work of this type. Because of the alternating cutting cycles for the rams and tables, broaching is practically continuous; ways are hardened, ground and automatically lubricated for long productive life span; pre-set cycle control safeguards the operator. ¶ Our Application Engineers will give you the benefit of their experience in recommending and tooling up new CINCINNATI machines—milling or broaching—for the lowest cost production of your work. And if you're not familiar with the new CINCINNATI Duplex Vertical Hydro-Broach Machines with receding tables, write for literature.

THE CINCINNATI MILLING MACHINE CO.
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News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 113, No. 1 July 1, 1955

Big Gains Seen In Sales Of Car Cooling Systems

Whether the demand for car air conditioning systems will ever reach a substantial proportion is an open question, but the present upward trend in the sale of the units is significant. It has been estimated that 1.5 per cent of all cars built this year will be equipped with air conditioning, compared with 0.8 per cent last year.

Nash reports some impressive figures on sales of air cooling systems for its cars. The units are currently being installed on 17 per cent of all Ambassador models, six per cent of Statesman models, and more than nine per cent of Ramblers. The company forecasts that 10 per cent of all its 1955 cars will be equipped with the units, compared with 5.4 per cent for the 1954 models.

Famed Atom Scientist To Head GM Research

Dr. Lawrence R. Hafstad, at one time director of reactor development of the Atomic Energy Commission, will become director of General Motors' research staff. He will succeed Charles L. McCuen, who will retire this year after 29 years of service.

$625 Million Ford Expansion Includes New Engine Plant

Ford Motor Co. is moving ahead rapidly with its recently announced $625 million expansion program. Almost immediately following signature of its new three-year labor pact, the company disclosed that it will construct a new engine plant near Lima, O.

The 950,000 sq ft plant, to be located on a 270-acre site, is scheduled for completion some time in 1957. A company statement that "the plant will not replace existing facilities" indicates that it may be used to turn out V-8 engines for a new car Ford reportedly plans to add to its present line.

This will be the fourth new engine plant under the company's postwar expansion program, which ultimately will total more than $2 billion. Announced in April, the new $625 million program includes, in addition to the engine plant, a new 580,000 sq ft addition to the Livonia automatic transmission plant.

Ford's third major project under the expansion program will include the Cleveland area engine plants and foundry. When the program is completed, plant No. 2, which will be expanded by 300,000 sq ft, will be turning out both V-8 and six-cylinder engines. Equipment will be arranged at plant No. 1 for production of V-8's exclusively.

The adjacent foundry, which supplies castings for both plants, will be expanded by about 25 per cent with the addition of a 700,000 sq ft unit. Eventually, the foundry also will provide some castings for the aforementioned Lima, O., engine plant.

CESSNA HELICOPTER SHOWS GOOD PERFORMANCE

The Cessna CH-1 helicopter has a maximum gross weight of 3000 lb and a maximum speed at sea level of 122 mph. An all-metal machine with a single main lifting rotor and a conventional tail rotor, it is powered by a Continental FSO-470-A engine which delivers a net 260 hp to the transmission.

Further GM Expansion Raises Ante to $4 Billion Since War

General Motors Corp. has announced a new $500 million expansion program, which is expected to be completed by the end of next year. Although it will include construction of about 6.3 million sq ft of floor space, a major portion of the outlay will be for new machine tools, presses, and other facilities.

Fisher Body Div. will be a prime beneficiary of the program. Seven existing plants will be enlarged and two new ones will be built—one at Mansfield, O., and another at a site to be announced later.

It was also reported that Buick is due to receive a sizable allocation of the new funds for the purchase of new machines and tools for all plants. Its main engine plant and office building will also be enlarged.

The new program will bring to $4 billion by the end of 1956 the funds GM will have spent since the end of WW II on new plant space and equipment in the U. S. and Canada.

News of the AUTOMOTIVE

ALL-IN-ONE FREIGHT AND PASSENGER COACH

This unique 40-ft combination freight and passenger coach has a rating of 50,000 lb with an unladen weight of 24,600 lb. It provides recliner seats for 20 passengers and in excess of 900 cu ft in the freight compartment. Built by Crown Body & Coach Corp., it has a wheelbase of 275 in. The coach is powered by a 779 cu in. Hall-Scott amidship underfloor gasoline engine that develops 238 bhp at 2200 rpm.

DIE CASTER

This new 400-ton die casting machine at the Edmore, Mich., plant of Carboloy Dept. of General Electric Co., casts aluminum sheathes on large magnets, such as those used in radar installations. In casting the 1/4-in. thick aluminum casing at 2000 psi around the magnets, no special holding methods are needed to keep them on the two-piece cavity die. Pressure of 3000 psi ejects finished work from the machine.

BABY DUMPER

Built-in roller flywheel is said to improve traction on British baby dumper made by H. R. Nash, Ltd. Cast iron drum is carried on each rear half-axle and rotates with its respective wheel. Normal drive is by chain to the left wheel only with other wheel running free. Dumper is made in three sizes of 8, 10, and 15 cu ft capacity. Each is powered by a single-cylinder, aircooled engine.

Packard Luxury Cars Said To Retain Values Longer

Higher-priced cars now depreciate at a slower rate than the lower-priced units, according to a survey by Packard. The division found that Packards which sold new for from $2,800 to $4,100 are retaining a greater share of their original value than they did prior to 1954. One- and two-year old models were topped only by two makes in the low and medium price field on the used car market, Packard claims.

On two-year-old Packards, the retention factor was found to have increased by as much as 11 per cent over those on the market prior to 1954, when higher-priced cars depreciated faster than the lower-priced units. This new turnabout in the depreciation rate of its automobiles, Packard feels, is contributing substantially to the company's efforts to regain its position in the luxury car field.

GM Experimental Diesel Train To Feature a New Suspension

Announcement by General Motors Corp that it will build a new type of passenger train does not necessarily indicate the corporation has plans to enter the railroad coach building business. The train, consisting of 10 coaches and a Diesel locomotive basically, will be an experimental model designed to give the railroad industry an idea of how it possibly can cut maintenance costs and improve future models. GM six years ago designed and built a "Train of Tomorrow," and several features from it have been applied to present trains.

Expected to be shown to the public later this year, the GM train will have capacity for 400 passengers and reportedly will reach speeds topping 100 miles. The cars themselves have been adapted from the body of GMC's 40-passenger inter-city highway coach, which features air suspension. A lower center of gravity, which railroads have been trying to achieve, is said to have been made possible in the new train. The cars are 10 in. lower than standard railroad coaches.

As in the GMC bus, baggage compartments are located under the floor.

The locomotive is powered by a 12-cylinder GM Diesel engine with 1200 hp for traction.

Debut at Powerama; Other Exhibits

Just at presstime, it was announced that the new train will be one of the central features at the Powerama exposition to be staged on Chicago's lakefront from Aug. 31 through Sept. 25, (see AI, June 15, p. 106). It later will be demonstrated on major railroad systems.

A score of other Diesel and gas-turbine-powered equipment, ranging from a cotton gin to the world's largest dump truck, will also be displayed at the show. Detroit Diesel Engine Div. will exhibit for the first time, two new aluminum models of marine propulsion engines. A 200-hp unit, representing the 100 millionth hp in Diesel engines produced by GM, also will be spotlighted at the show.

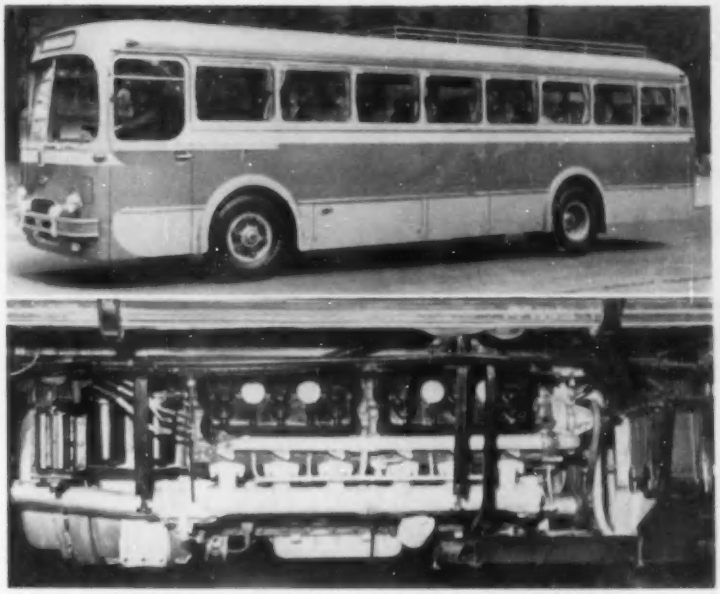
Some of the other attractions at the exposition will include a full-scale exhibit depicting all steps in building an actual road and the roadbuilding machinery; an M-48 tank; a model of the "Pogo" a vertical rising aircraft; oil drilling rig; saw mill; and other varied equipment. An array of marine equipment and craft will be moored in a lagoon along a specially-built pier for the inspection of visitors.

Wright Awards Jet Parts Order to Solar Aircraft

Solar Aircraft Co. has received a $2.3 million order from Wright Aeronautical Div. of Curtiss-Wright Corp. for afterburners and other components for late model turbojet engines. The company is also said to be completing negotiations for a large contract to develop and build afterburners for a British concern.

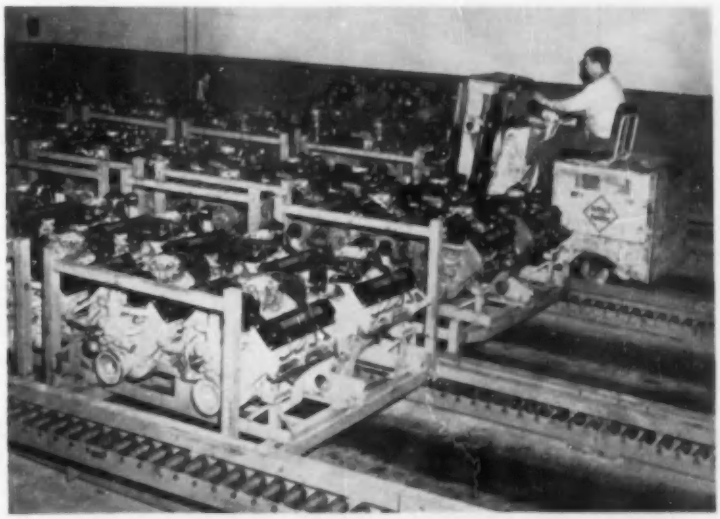
Nash Grants Franchises To 44 More Car Dealers

Nash in May added 44 more new car dealers to its organization, to bring to 292 the total number of new car franchises granted by the division since the beginning of the year. Nash approved 40 franchises in January, 100 in February, 57 in March, and 51 in April.



FIAT BUS WITH UNDERFLOOR DIESEL ENGINE

First underfloor-engined coach to be produced by Fiat has an all-steel, integrally constructed chassis-body. Powered by a standard 651 cu. in., six-cylinder Diesel engine developing 140 bhp, it has a seating capacity of 65 persons and is 433 in. long.



INTEGRATED MATERIALS HANDLING AT PACKARD

One of the major features of the materials handling set-up at the Packard Utica, Mich., plant is an integrated fork truck-container system for transporting parts to storage and production lines, and transport of finished parts to shipping docks. Shown here is an Elwell-Parker fork truck arranging racks loaded with four engines on the final storage lines prior to shipment to the Connor assembly plant.

News of the AUTOMOTIVE

Test mechanic at new Ford Farm Machinery Research and Engineering Center is shown measuring the performance and ruggedness of a hydraulic pump. Abrasive materials are added to hydraulic oils to subject hydraulic systems to more punishment than they would receive in years of actual field work.

Cutback In Tank Production Unlikely For Another Year

The Army has denied reports that it is considering a cutback in the production of M-48 medium tanks. Although the M-48 tank program at Fisher Body's Grand Blanc plant will "phase out" this August, production of the tanks will remain at about the same level, since Chrysler is now getting into its program more actively.

Any cutback in tank output is not likely for at least another year. Chrysler was awarded a $160 million contract last September for production of M-48 tanks, and that contract will not expire until June, 1956. The corporation is producing the tanks at the Newark, Del., arsenal and expects to continue to do so in the foreseeable future. Present production rate remains a closely guarded secret.

Fisher Body started producing M-48 tanks in 1951 under a multi-million dollar Army contract. The last tank rolled out of the Grand Blanc plant May 19, but a supplemental tank engineering modification program will keep the plant active until August. The 1.2 million sq ft facility then, reportedly, will be converted into an automobile body stamping plant.

1955 RETAIL CAR SALES BY PRICE GROUPS*

Number of Cars

	April				Four Months			
	1955		1954		1955		1954	
Price Group	Units†	% of Total	Units†	% of Total	Units†	% of Total	Units†	% of Total
Under $2,000	350,397	54.09	297,493	58.80	1,171,944	53.48	993,565	55.72
$2,001 to $2,500	203,948	31.48	128,415	25.38	689,338	31.46	441,040	26.07
$2,501 to $3,500	75,056	11.58	59,024	11.67	263,621	12.03	183,495	10.94
Over $3,500	18,475	2.85	21,019	4.15	66,970	3.06	73,957	4.37
Total	647,876	100.00	505,951	100.00	2,191,781	100.00	1,692,057	100.00

Dollar Volume of Sales

	April				Four Months			
	1955		1954		1955		1954	
Price Group	Dollars	% of Total	Dollars	% of Total	Dollars	% of Total	Dollars	% of Total
Under $2,000	$ 664,785,841	46.51	$ 541,974,420	50.19	$2,225,675,475	46.82	$1,809,644,648	50.24
$2,001 to $2,500	476,700,344	33.35	293,994,402	27.22	1,608,612,270	33.12	1,007,179,978	27.97
$2,501 to $3,500	212,915,332	14.89	162,143,107	15.01	749,370,528	15.43	501,266,678	13.92
Over $3,500	75,103,553	5.25	81,829,389	7.58	273,369,218	5.63	283,323,163	7.87
Total	$1,429,485,070	100.00	$1,079,941,298	100.00	$4,857,030,491	100.00	$3,601,414,462	100.00

* Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four-door sedan or equivalent model. Does not include transportation charges or extra equipment.

† New registrations of American made cars only. Does not include imported foreign cars.

Ford Opens a Complete Center For Farm Machinery Research

Ford's new Farm Machinery Research and Engineering Center in Birmingham, Mich., opened formally on June 8, marks another step in the company's efforts to help solve farm problems. Significant, also, is the company's recent grant of $100,000 to the Univ. of Michigan for fundamental research on the relationship between plant roots and soil. The university already has made notable contributions to research on plant sciences, and the Ford grant will enable it to intensify its activities in the field.

The new multi-million dollar Ford research center includes the most modern facilities which will enable engineers to test farm machinery under the most adverse conditions encountered by the farmer. In addition to indoor laboratories designed to check performance of tractor engines, transmissions, axles, and various other components, the center will have specially designed "torture courses" for testing pre-production farm machinery models.

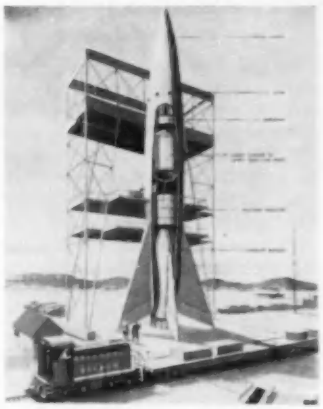
The 112,000 sq ft center contains three different types of dynamometer test cells and five laboratories. These include: a laboratory for plastic experimentation; a unit for determining stress and strain; a chemical and metallurgical laboratory; a fatigue laboratory for testing bearings and metal; and a quality control unit. The center also has a large area for building up and tearing down various types of machinery.

Beech Aircraft May Produce French Jet Executive Plane

If licensing negotiations succeed, Beech Aircraft Corp. will manufacture in the U. S. a new jet-powered executive plane. Built by Morane Saulnier of France, the four-passenger craft reportedly will fly at 410 mph and will sell for a price in the neighborhood of $300,000.

The French version uses twin Turbomeca Marbore jets. If made in this country, however, the plane is expected to be powered by Continental J 69 jets, according to the latest available information.

AND AVIATION INDUSTRIES



FUTURISTIC ROCKET

Shown here is how components of an atomic-powered, passenger-carrying, interplanetary rocket might be arranged, if such a rocket were constructed. Drawing is artist's conception produced at the General Electric Co.

Wilton Tool Mfg. Co. Moves Into New Plant

Wilton Tool Mfg. Co., Inc., has recently completed occupancy of a new general office and factory building at 9525 Irving Park Rd., Schiller Park, Ill. The new $500,000 structure has a total of 68,000 sq ft of floor space.

The building is said to incorporate most advanced machine tool production facilities and methods. Wilton is well-known in many industrial fields for its manual and automatic vises, work positioners, and C-clamps.

General Motors Names Scholarship Winners

General Motors Corp. last month (June) announced the names of the first 100 students who have won scholarships under the corporation's $2 million annual program of aid to higher education. The students were selected from among nearly 1500 semi-finalists and more than 14,000 applicants.

Each of the winners will receive from $200 to $2,000 for college expenses, depending on individual needs. In addition, each of the colleges selected by the winning students will get from $500 to $800 a year.

AI TABLOID

The new Douglas DC-8 swept-wing passenger jet transport plane will be powered by an advanced version of the Pratt & Whitney J-57 engine.

* * *

Norton Co. has announced a new group of oxide refractory coatings to increase temperature ranges within which metallic parts can perform successfully.

* * *

Clevite Corp. is purchasing Wallace Aviation Corp. . . . A. V. Roe Canada, Ltd., is reported to have made a $22 million offer to buy Canadian Car and Foundry Co., Ltd. . . . H. K. Porter Co., Inc., has purchased Vulcan Crucible Steel Co.

* * *

Diesel Energy Corp. is setting up sales and service facilities in the U. S. for the products of Kloeckner-Humboldt-Deutz AG of Germany. It will concentrate on the sale of aircooled Diesel engines here.

* * *

Ethyl Corp. has introduced a new "Motor Plus" anti-knock compound . . . Electric Auto-Lite Co. has developed a new high-temperature aircraft wire.

* * *

Versenes, Inc., subsidary of Dow Chemical Co., has been absorbed into the parent organization.

* * *

Thompson Products, Inc., is making available for public showing a color film on Pennsylvania's motor vehicle inspection law . . . Link-Belt Co. is now offering a motion picture on shell molding.

* * *

Wheelco Instruments Div. of Barber-Colman Co. has moved its Chicago office to 6610 North Sheridan Rd., Chicago 26, Ill. . . . Dukes Co. has transferred its production facilities to a new plant in Schiller Park, Ill.

North American Aviation, Inc., has established a separate Nuclear Engineering & Manufacturing Div. The company is also constructing a nuclear research laboratory in Canoga Park, Calif.

* * *

Reynolds Metals Co. has a patent on a new aluminum fiber for tires.

* * *

American Airlines has ordered 35 new Electra transport planes, powered by the Allison Model 501 turboprop engine, from Lockheed Aircraft Corp. Trans World Airlines and Air France recently placed orders with Lockheed for a total of 36 Model 1649A Super Constellations, powered by four Wright turbo-compound engines.

* * *

Allis-Chalmers Manufacturing Co. has introduced the Model D motor grader with a new six-cylinder Diesel engine rated at 50 bhp at 1625 rpm.

* * *

Strick Plastics Corp. is now enfranchising distributors to make its pre-assembled plastic truck bodies.

* * *

Electric Auto-Lite Co. has acquired a 213,550 sq ft plant in Syracuse, N. Y., to consolidate its manufacturing operations in that city under one roof . . . Prenco Products, Inc., has purchased a new plant in Hazel Park, Mich. . . . Pace Corp. has acquired an additional 20,000 sq ft of manufacturing space in Base Line, Mich.

* * *

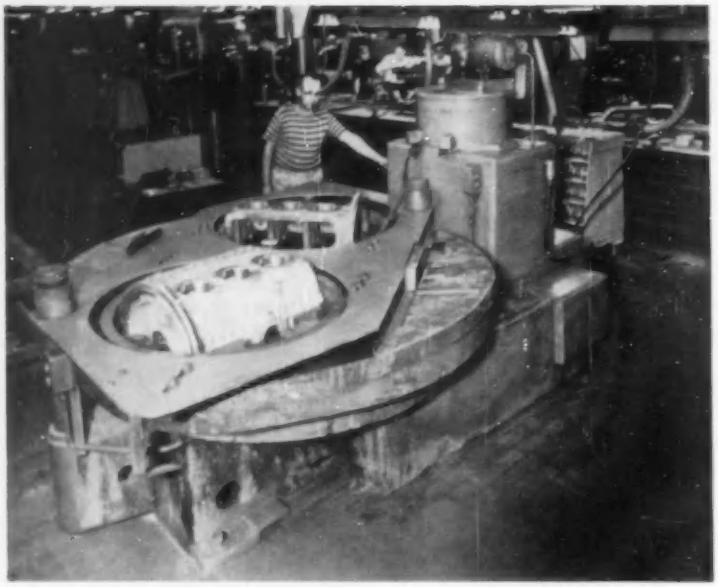
Malayan Tin Bureau reports that U. S. industries consumed almost 11 per cent more tin in the first three months of this year than in the same period of 1954.

* * *

Boeing Airplane Co. is putting a new icing tunnel into operation.

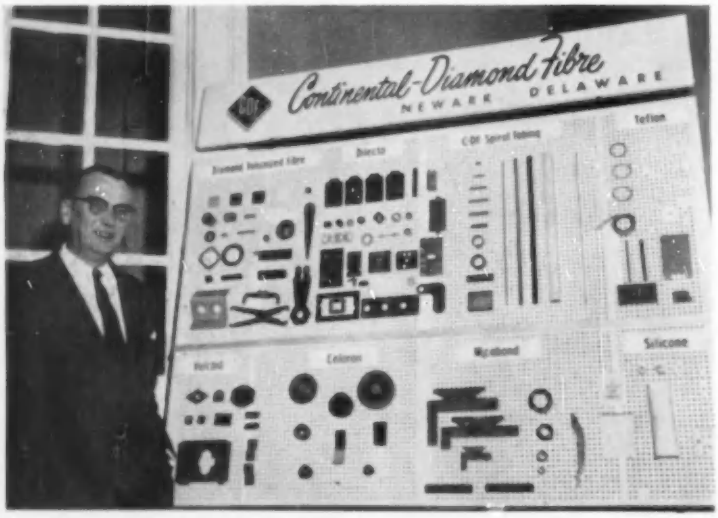
(Turn to page 104, please)

News of the AUTOMOTIVE



CRANE LAPMASTER IN ACTION AT CONTINENTAL

One of the most novel applications of the Crane Lapmaster machine is at the military engine plant of Continental Motors Corp., Muskegon, Mich. Illustrated here is one of a number of 84-in. Lapmasters arranged for lapping the joint face of crankcase sections for six-cylinder, aircooled engines. The lapping process was adopted to assure needed smoothness and flatness of these faces to promote oil tightness. In regular production, two sections are lapped at a time as shown. These surfaces are held to a tolerance of 0.0007 in. for flatness, while surface finish is held to 10 microinches (rms).



Edward G. Budd, Jr., president of The Budd Co., beside a display of C-D-F products.

Fiat Licensed by GE To Build J47 Engine

General Electric Co.'s J47 engine recently became the first U. S. aircraft jet engine to be licensed to a European manufacturer. As a result of recent agreements made by GE with the Fiat Works of Turin, Italy, the latter will build the J47-GE-27 and the J47-GE-33.

The license agreements were negotiated by the International General Electric Co. with the cooperation of the Air Force and State Dept. Besides licensing Fiat to build J47 engines, GE has also licensed the company to build spare parts and overhaul the engine.

Budd Plans Progressive Growth Of Newly Acquired C-D-F Unit

Continuous growth and development of its new wholly owned subsidiary — Continental-Diamond Fibre Division of The Budd Co., Inc.—are planned by Budd. It assumed ownership and management of the concern on July 1.

Operation of C-D-F, a major producer of electrical insulation and plastics, will be carried on by the present working force and management personnel with one or two exceptions. The Continental-Diamond Fibre name will be retained.

Sale of major C-D-F assets to Budd was approved by the former's stockholders on May 17. Included in the sale are plants in Newark, Del.; Bridgeport, Pa.; Valparaiso, Ind.; and Spartanburg, S. C.; and subsidiaries in Canada and France. The plant in Marshallton, Del., and a British subsidiary were not included in the transaction.

It is interesting to note that 17 per cent of C-D-F's sales of approximately $18 million in 1954 were to the automotive industries. Aside from acquiring the major assets of C-D-F for purposes of diversification, Budd expects that the former's products will supplement to some extent its own operations in making passenger car bodies, chassis frames, fenders, truck components, railway cars, trailers, dies, jigs, tools, fixtures etc.

AND AVIATION INDUSTRIES

Holley Plant Purchased By Metal Products Co.

Holley Carburetor Co. expects to complete transfer of its operations from the Vancouver St. plant in Detroit to new expanded facilities north of the city by the end of the year. The 36-year-old Vancouver plant was sold recently to American Metal Products Co.

Four Million Cars Turned Out; Stocks Begin to Show Decline

Despite the rash of wildcat strikes at General Motors and Ford plants throughout the country, the automobile industry last month turned out its four-millionth car, about two months ahead of the previous record set in 1950. Present estimates are for production of three million cars during the second half for a grand total of about seven million units for 1955, an all-time high.

Although stocks of new cars in dealers' hands climbed to a record of more than 800,000 units in June, the increase from the beginning of May to June was the smallest since 1955 models were introduced. Due to continued high sales in May, inventories increased by slightly under 79,000 units, compared to an increase of more than 100,000 units from April to May.

All GM divisions again shattered previous monthly sales records in May with total deliveries of 354,556 units. The high retail sales in May also resulted in a record five-month period for GM, as sales totaled 1,597,653 units.

Although Ford has been leading Chevrolet in sales, the margin between the two has been narrowing in recent weeks. Based on official registration figures, Ford for the first four months was ahead of Chevrolet by more than 20,000 units, but, at the end of May, Chevrolet closed in on Ford to the point where there was only a difference of about 600 units.

Mercury, now out on its own as a separate division, is showing impressive records. Sales totaling 38,887 units in May shattered all previous monthly records for the third straight month.

FOREIGN CAR SALES NEARLY DOUBLE FIGURE FOR 1954

1955 New Passenger Car Registrations*

Arranged by Makes in Descending Order According to the 1955 Four Months' Totals

MAKE	April 1955	March 1955	April 1954	FOUR MONTHS Units 1955	Units 1954	Per Cent of Total 1955	Per Cent of Total 1954
Ford	136,502	134,908	121,475	463,949	410,284	21.27	24.14
Chevrolet	139,527	135,482	126,255	443,796	412,858	20.35	24.29
Buick	71,127	69,236	50,359	240,629	155,302	11.04	9.13
Plymouth	63,536	61,689	37,926	217,651	135,466	9.98	7.97
Oldsmobile	53,285	51,463	38,643	183,264	108,265	8.41	6.37
Pontiac	48,569	47,896	32,560	167,057	114,633	7.66	6.75
Mercury	32,834	32,192	25,603	107,900	99,690	4.95	5.87
Dodge	28,174	27,160	14,148	94,522	50,300	4.34	2.97
Chrysler	15,311	15,929	9,794	56,431	37,477	2.54	2.21
Cadillac	13,072	13,420	11,169	49,426	31,342	2.27	1.84
De Soto	11,784	11,737	7,396	40,412	27,447	1.85	1.62
Studebaker	10,017	10,412	8,966	34,126	32,216	1.57	1.90
Nash	9,793	7,980	6,267	26,551	26,952	1.22	1.59
Packard	5,736	5,521	3,741	15,923	16,507	.73	.97
Hudson	5,066	4,126	2,779	13,901	10,644	.64	.63
Lincoln	2,755	2,564	3,589	9,248	12,533	.42	.74
Willys	900	946	1,670	3,060	6,972	.14	.38
Kaiser	122	109	1,153	654	2,915	.03	.17
Misc. Domestic	16	22	537	150	1,298	.01	.08
Foreign	3,807	3,746	2,068	12,610	6,940	.58	.41
Total—All Makes	651,855	636,534	508,102	2,180,371	1,699,123	100.00	100.00

* Based on data from R. L. Polk & Co.

The independent automobile manufacturers are also continuing to do comparatively well. Hudson sales for the period ended May 31 were double those of the same period in 1954, while Nash sold more new cars in May than in any month since September, 1953.

Kaiser's "ace-in-the-hole"—the Willys Jeep—continues to make gains. For the first five months, factory sales of Willys commercial vehicles soared to 12,243, a 90 per cent increase over the 6444 units produced during the same period last year.

Continued on Page 100

APRIL SALES SHOW GAIN OF 15,000 UNITS OVER MARCH

1955 New Truck Registrations*

Arranged by Makes in Descending Order According to the 1955 Four Months' Totals

MAKE	April 1955	March 1955	April 1954	FOUR MONTHS Units 1955	Units 1954	Per Cent of Total 1955	Per Cent of Total 1954
Ford	27,993	25,307	24,375	91,399	87,477	34.66	32.46
Chevrolet	24,660	16,024	26,546	79,732	92,053	28.90	34.52
International	9,334	8,723	7,694	33,309	26,906	12.71	9.99
Dodge	5,026	5,782	5,289	20,745	20,550	7.92	7.63
G.M.C.	4,691	3,670	6,654	17,369	23,721	6.63	8.80
Willys Truck	1,471	1,353	634	5,270	1,864	2.01	.69
White	1,239	1,031	1,202	4,210	4,141	1.61	1.54
Studebaker	1,129	1,091	1,086	3,742	3,623	1.43	1.34
Willys Jeep	935	792	611	3,024	2,390	1.15	.89
Mack	1,000	791	560	2,866	1,839	1.08	.68
Diamond T	327	309	241	1,093	920	.42	.34
Divco	289	280	202	982	830	.37	.31
Reo	297	183	181	818	824	.31	.31
Brockway	94	89	96	366	398	.14	.15
Kenworth	87	82	50	316	187	.12	.07
Peterbilt	44	39	17	123	103	.05	.04
F.W.D.	19	22	44	75	152	.03	.06
Federal	3	6	45	15	148	.01	.05
Misc. Domestic	64	45	59	210	257	.08	.10
Foreign	190	99	22	488	60	.18	.02
Total—All Makes	79,071	64,732	75,504	262,027	269,452	100.00	100.00

* Based on data from R. L. Polk & Co.

"Over 8 years . . . complete satisfaction . . . excellent performance"

COMMERCIAL SCREW MACHINE PRODUCTS, Inc., Horseheads, New York, reports on its experience with *Texaco Cleartex Oil*. Mr. C. L. Shull, President, states:

"*Texaco Cleartex Oil* has been in use in our plant for over eight years, with complete satisfaction. We have taken advantage of its dual-purpose ability and have used it both as a cutting coolant and a machine lubricant.

"The excellent performance of *Texaco Cleartex Oil* has been amply demonstrated. We highly recommend this product as a dual-purpose oil."

Texaco Cleartex Oil is one of a complete line of *Texaco Cutting, Grinding, Soluble and Hydraulic Oils* designed to help you do all your machining better, faster and at lower cost.

Let a Texaco Lubrication Engineer help you gain these benefits for your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

COMMERCIAL SCREW MACHINE PRODUCTS makes automatic screw machine products for the radio, television and automotive industries. *Texaco Cleartex Oil* is giving outstanding results as a dual-purpose oil in small, high speed Davenports and larger Cones and Gridleys, machining a wide range of materials including 416 stainless and the tougher machining alloy steels. Excellent finish and extended tool life are among the benefits reported.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN . . . TEXACO STAR THEATER starring DONALD O'CONNOR or JIMMY DURANTE on television . . . Saturday nights, NBC.

Men in the News

Martin Co. — William B. Bergen has been elected executive vice-president.

Bullard Co.—Frank U. Hayes has been named assistant general manager, and H. Edward Neale has been chosen to succeed him as sales manager.

Autocar Div., White Motor Co.—Karl A. Roesch was appointed general manager.

New Departure Div., General Motors Corp.—**Raymond J. Lynch** has been named coordinator of farm implement sales engineering, and **Richard H. Valentine** succeeds him as assistant chief engineer. **Joseph Pickl** is now Detroit zone sales manager, and **J. Robert Jameson** takes his place as Cleveland zone sales manager.

Denison Engineering Co.—**Paul W. Norris** was promoted to vice-president and director of sales.

Mechanics Universal Joint Div., Borg - Warner Corp. — **Frank W. Richard** has been elected general manager, and **Chester E. Palmer** has been named executive vice-president.

Maxwell Co.—**M. C. Hutto** is now general manager.

Studebaker Div., Studebaker - Packard Corp. — Robert S. Schuyler has been made sales manager of the Truck Dept.

Packard Div., Studebaker-Packard Corp.—**Eugene B. Rebhan** has been appointed national used car manager.

GMC Truck & Coach Div., General Motors Corp.—**Carl D. Rogers** was named general superintendent of assembly plants; **T. C. Fellows**, superintendent of truck assembly; and **N. P. Kilgore**, coach assembly superintendent.

Allis-Chalmers Mfg. Co.—**J. W. McMullen** is now vice-president and general manager of the Power Equipment Div.; **P. F. Bauer**, general manager of the Industrial Equipment Div.; **William W. Wallace**, head of the General Products Div.; **L. W. Davis**, head of the Farm Equipment Div.; and **Boyd S. Oberlink**, vice-president and general manager of the Construction Machinery Div.

Carboloy Dept., General Electric Co.—**Frank M. Mansfield** has been made manager of product planning and marketing research.

New Departure Div., General Motors Corp. —Robert H. Wilkie has been appointed merchandising manager of the Sales Dept.

Rinshed-Mason Co. of Canada, Ltd. —**James P. Shropshire** has been promoted to general sales manager.

American Motors Corp.—**George E. Gullen, Jr.**, was named director of labor relations.

Martin Co.—**Earl R. Uhlig** has been elected vice-president of finance.

(*Turn to page* 104, *please*)

Holley Carburetor Co. — George Freeland has been appointed advertising manager.

Birdsboro Steel Foundry & Machine Co.—Alexander Zeitlin was elected vice-president.

Necrology

Morris K. Clark, 59, managing director of the Foreign Distributors Div. of General Motors Corp., died June 8, at New York.

George W. Malcomson, Sr., Washington representative of Chrysler Corp. and son of one of Henry Ford's original partners, died recently, at Washington, D. C.

William M. Mettler, 63, assistant secretary of Goodyear Tire & Rubber Co., died June 7, at Akron, O.

Walter Reid, 86, former board chairman of Mack Truck Co., died recently, at Portland, Me.

Edmund J. Phelan, 55, vice-president of Cia. Hulera Euzkadi (Mexican affiliate of B. F. Goodrich Co.), was killed recently in an automobile accident, near Mexico City.

Rene de Knyff, 90, pioneer automobile race driver and a director of Panhard & Levassor Co., died recently, at Paris, France.

Kurt R. Vogel, 57, secretary of Crucible Steel Co. of America, died June 7, at Pittsburgh, Pa.

Fuller F. Barnes, 68, retired president and chairman of the board of Associated Spring Corp., died June 18, at Bristol, Conn.

Roy L. deBrauwere, assistant general manager of Schrader Div. of Scovill Manufacturing Co., died June 18, at Lynbrook, N. Y.

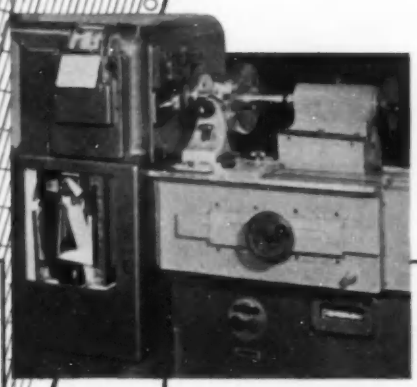
Hiram G. Barbee, 70, retired vice-president in charge of sales of the Chicago Pneumatic Tool Co., died June 16, while visiting relatives in New York City.

5 ways

FELLOWS GEAR INSPECTION INSTRUMENTS PAY FOR THEMSELVES

Fellows
RED LINERS

Automatically record all gear errors in combination on a chart, from which the nature and extent of each kind of error discloses itself. 3 capacities to 18 inches p.d.



Fellows
LEAD MEASURING INSTRUMENTS

Also check crown and taper. Two capacities: 12" and 24" p.d. Chart errors at 500 to 1 magnification. No involved calculations in setting for various helix angles.

THE *Fellows*

1. *Fewer "Rejects"*

Fellows Gear Inspection provides positive quality control during production runs . . . puts the finger on gear errors before costly waste occurs.

2. *Longer Cutter Life*

Competent Gear Inspection routines and instruments help to determine period of efficient cutter or finishing tool performance between sharpenings . . . prevent over-use and keep stock removal per sharpening at a minimum.

3. *Less Production Time Lost*

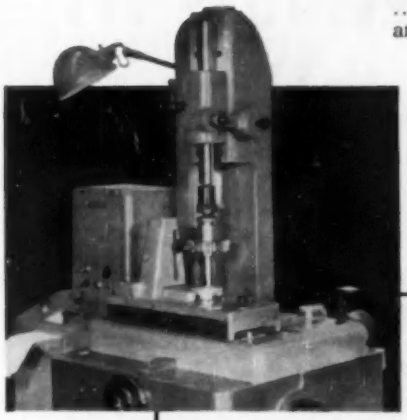
Fellows Gear Inspection identifies the nature of gear errors and permits fast correction . . . before expensive hours of machine time and labor are wasted.

4. *"Fool-Proof" Assembly*

Fellows Gear Inspection gives proof-positive that specified gear limits have been met before costly man-hours have been invested in assembly.

5. *Improved Customers' Good Will*

If you are making gears for your own use . . . Fellows Inspection Instruments assure superior gear performance throughout the service life of your product. If you are making gears for another manufacturer . . . Fellows Instruments give you CHART RECORDED PROOF beyond argument of the delivery of specified precision.



There's a Fellows Gear Inspection Instrument to help every type of operation to increase profits. Why not discuss this important matter with your Fellows Representative soon? If interested, ask him for data about The Fellows Plan for deferred payments. Write, wire or phone any Fellows Sales Office.

Fellows
INVOLUTE MEASURING INSTRUMENTS

Feature electronic recorders. Permanent chart records at 500 to 1 magnification. Measures the location and amount of any planned-for involute modifications. 12 and 24 inch capacity models.

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See this production problem solved on a Special Greenlee Bar Automatic. It will be in normal production operation here at the show.

GREENLEE CAN HELP SOLVE YOUR PRODUCTION PROBLEMS

The creative know-how that built this special auger-bit machine is available to you. Make full use of Greenlee specialized engineering skills and ingenuity. Take advantage of its cost saving possibilities.

GREENLEE

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write for further information

AGAIN IN 1955...

STROMBERG CARBURETOR helps win top award in famed Mobilgas Economy Run!

For the second straight year, the Stromberg Carburetor has led the field in the grueling Mobilgas Economy Run. The Studebaker Commander Custom V-8 which took top honors in the Sweepstakes Division for 1955 was Stromberg-equipped, as was the Studebaker Land Cruiser which won the 1954 edition of the classic.

In a three-day run from Los Angeles through Tucson and Albuquerque to Colorado Springs, the winning car braved hot desert sun, near zero temperatures and brutal crosswinds while covering the 1,323-mile route. Under these conditions, the Stromberg-equipped winner averaged 58.632 ton miles per gallon (and 27.437 actual miles per gallon).

For safe, sure, economical gasoline performance, Stromberg Carburetors have topped the field for forty years. The 1955 Mobilgas Economy Run is merely additional evidence that this leadership is still undisputed.

ECLIPSE MACHINE DIVISION OF BENDIX AVIATION CORPORATION

Original Equipment Sales: Elmira, N. Y. • Service Sales: South Bend, Ind.
Export Sales and Service: Bendix International Division, 205 E. 42nd Street, N. Y. 17, N. Y.

Stromberg® Carburetor
Bendix® Electric Fuel Pump
Bendix® Folo-Thru Starter Drive

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ECLIPSE MACHINE DIVISION

Bendix AVIATION CORPORATION

All industry will be interested in this announcement that Marman Products Company, Inc., Los Angeles, is now a wholly owned subsidiary of Aeroquip Corporation, Jackson, Michigan.

Marman is known as the outstanding producer of band clamps, V-band couplings, channel band couplings, stainless steel straps, flexible fuel line couplings, and the new LIVE joint system. Aeroquip is the world's leading producer of flexible hose lines with detachable, reusable fittings for industrial and aircraft applications, and a major supplier of self-sealing couplings.

On many leading makes of industrial equipment, Marman products and Aeroquip products work side by side as important components. Manufacturers as well as users gain timesaving and moneysaving advantages.

As a subsidiary of Aeroquip, Marman is in excellent position to expand its industrial sales, service, and engineering facilities. Please write for complete information.

MARMAN PRODUCTS COMPANY, INC.

A SUBSIDIARY OF Aeroquip CORPORATION

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MARMAN PRODUCTS ARE MANUFACTURED UNDER VARIOUS U.S. AND FOREIGN PATENTS AND OTHER PATENTS PENDING

Wherever throw-off, drip or squeeze-out is a problem...

USE SUNTAC OIL

OIL LEAKAGE MEANS:
higher lubrication costs
messy machines
hazardous oil slicks on the floor

SUNTAC OIL:
cuts leakage
lowers oil costs
minimizes hazardous floor conditions

In addition to its leak reducing properties, Suntac has all the high quality of expensive general-purpose oils. Suntac is fortified against oxidation to assure long oil life and against rust and corrosion to protect valuable machines. And, last but not least, because the leak-reducing agent is 100% petroleum, Suntac leaves no gummy film or residue.

For more information about Suntac, the oil especially made to prevent drip, throw-off and squeeze-out, see your Sun representative or write for your copy of Suntac Technical Bulletin to Sun Oil Company, Philadelphia 3, Pa. Dept. AA-7.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

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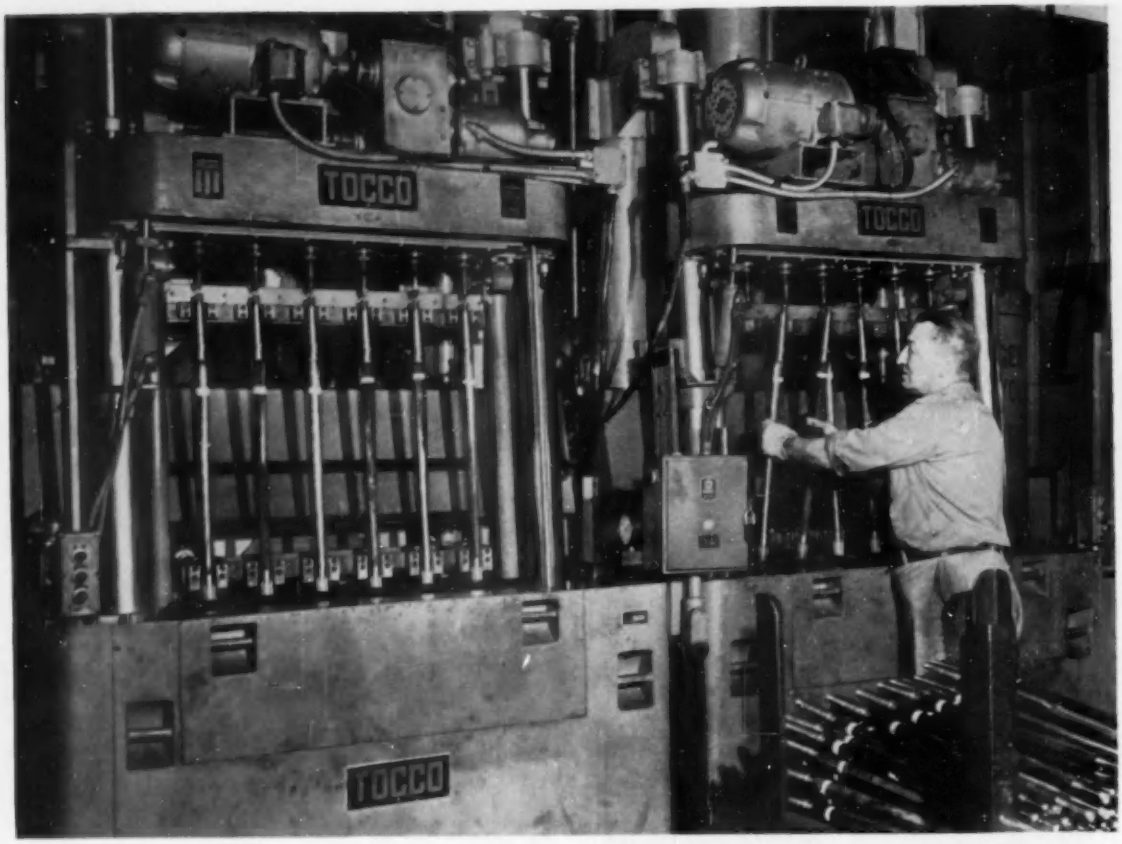


FIG. 1—Pair of six-place induction hardening machines now being used at the Lynch Road plant of Chrysler Corp. for rapid case hardening of axle shafts and tempering the taper to permit keyway cutting.

Induction Hardening Produces Stronger,

EXPERIENCE in hardening axle shafts for cars and trucks in Chrysler Corp. lines led metallurgical engineers of the company to conclude that the installation of suitable equipment would make it possible to case harden such shafts by induction heat-treating and that results attainable would be both satisfactory and highly economical. Subsequent production experience has confirmed these conclusions.

The two induction hardening machines, Tocco units, Fig. 1, are now in successful operation on a full scale production basis at Chrysler Corporation's Lynch Road Plant. At present, high-quality induction hardening performed under rigid specifications is applied to heavy-duty axle shafts assembled in Chrysler and DeSoto eight-passenger sedans and station wagons, DeSoto and Plymouth taxicabs and Dodge ½-ton and ¾-ton trucks.

Test results indicated that a minimum case depth was required to meet the specified static torsion yield strength of 24,000 lb-in. on SAE 1037 steel shafts. In this case, the effective case depth is interpreted to mean that depth at which the metallographic structure is 50 per cent martensite. Hardness of the first 0.100-in. depth has proved to be 50 Rc minimum. This hardness normally obtains for this depth if 45 RC hardness is present at 0.125-in. depth. From this depth inward, hardness drops to 35 Rc (the 50-per cent martensite hardness) at 0.160 in. below the surface and tapers out at about 0.280 in. depending upon the hardenability of the steel. It is required that case depth be measured on samples cut from the smallest diameter of the shaft.

Figure 2 is a graph made from a smallest diameter sample that gave 24,000 lb-in. torsional yield strength. Data show that, at 0.125 in. depth, the microstructure must be 75 per cent martensite to give a minimum

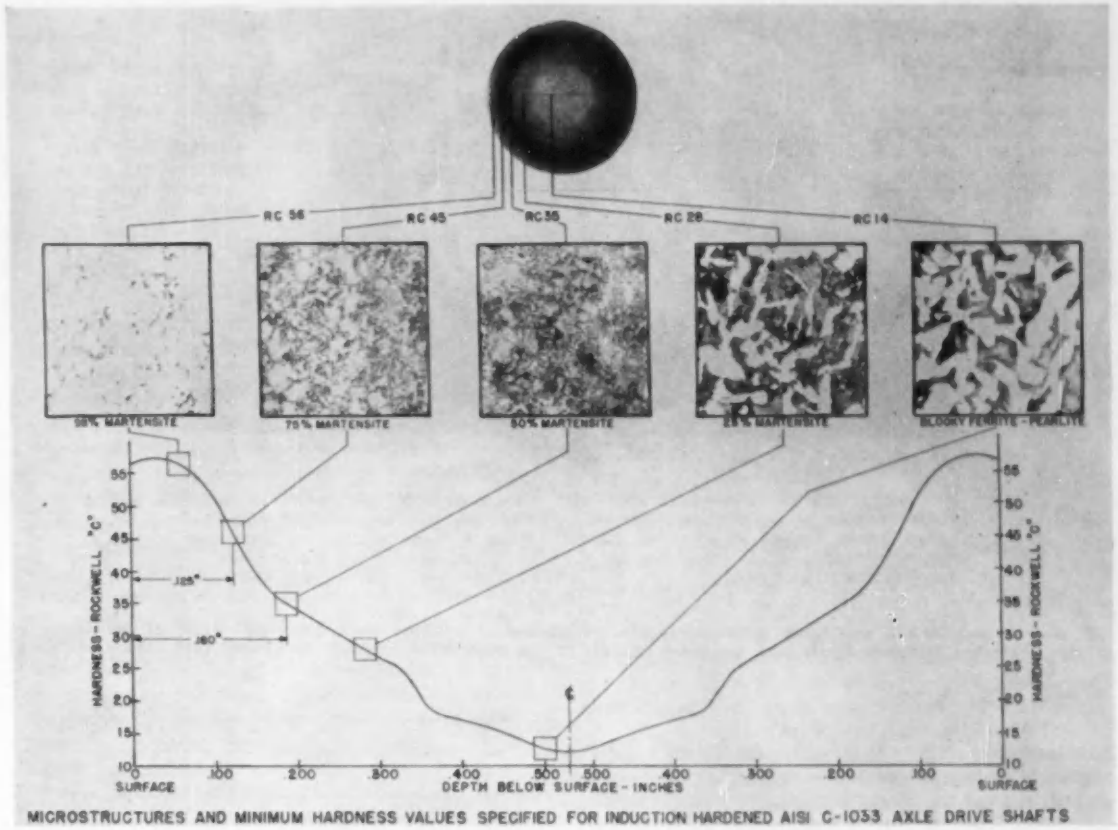


FIG. 2—Graph showing the microstructure and minimum hardness values specified for induction hardening of axle shafts for cars in Chrysler lines. Minimum case depth is 0.160 in.

Lower Cost Axle Shafts

by

Herbert Chase

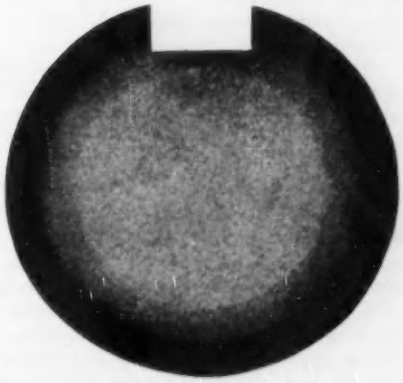


FIG. 3—Photomacrograph of a transverse section of an axle shaft at the keyway showing the depth of the keyway in relation to the hardness pattern. Case must be deep enough to prevent battering of the keyway.

hardness of 45 Rc and at 0.160 in. depth the structure must be 50 per cent martensite to produce 35 Rc hardness. Microstructure and hardness values in adjacent areas when the above minimum specifications are satisfied also are shown in Fig. 2.

At the tapered end, hardness depth must be deeper than the keyway, and Fig. 3 shows the transverse section depth pattern through the keyway representing minimum requirements. Keyway depth is 0.218 in., hence structure at the bottom of the keyway contains about 40 per cent tempered martensite having a hardness of about 25 Rc. Tempering has to be done to permit keyway cutting. It is necessary to meet the case depth requirement because, if the key does not have a good fit in the keyway, battering will occur.

Figure 4 shows (at A) a transverse etched section through the largest section of the (former) through

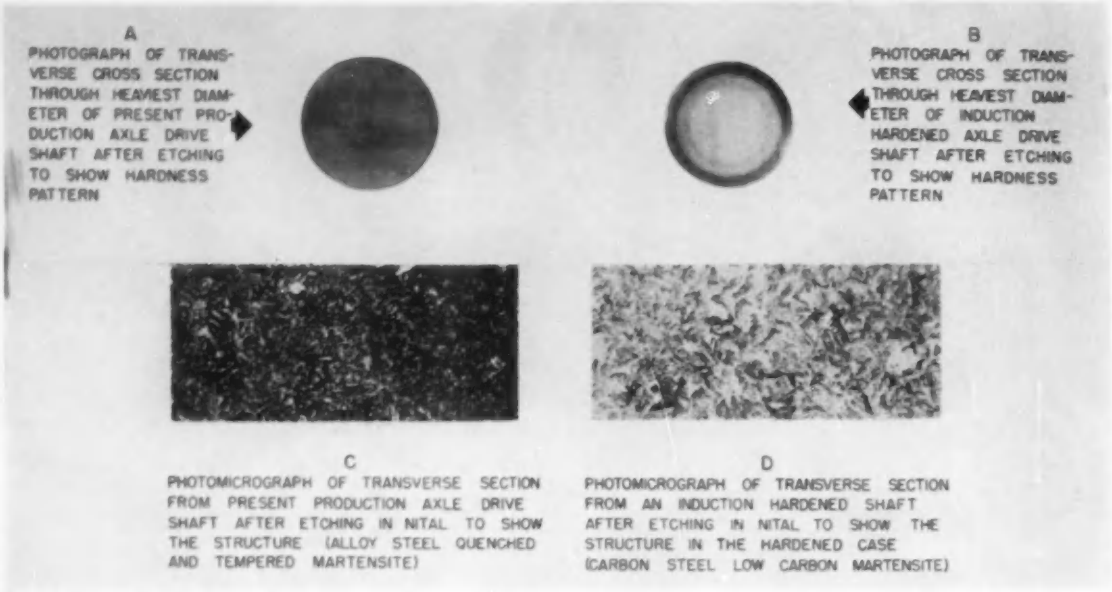

A
PHOTOGRAPH OF TRANSVERSE CROSS SECTION THROUGH HEAVIEST DIAMETER OF PRESENT PRODUCTION AXLE DRIVE SHAFT AFTER ETCHING TO SHOW HARDNESS PATTERN
B
PHOTOGRAPH OF TRANSVERSE CROSS SECTION THROUGH HEAVIEST DIAMETER OF INDUCTION HARDENED AXLE DRIVE SHAFT AFTER ETCHING TO SHOW HARDNESS PATTERN
C
PHOTOMICROGRAPH OF TRANSVERSE SECTION FROM PRESENT PRODUCTION AXLE DRIVE SHAFT AFTER ETCHING IN NITAL TO SHOW THE STRUCTURE (ALLOY STEEL QUENCHED AND TEMPERED MARTENSITE)
D
PHOTOMICROGRAPH OF TRANSVERSE SECTION FROM AN INDUCTION HARDENED SHAFT AFTER ETCHING IN NITAL TO SHOW THE STRUCTURE IN THE HARDENED CASE (CARBON STEEL LOW CARBON MARTENSITE)

FIG. 4—Axle shaft at top, and below, photomicrographs of sections at maximum shaft diameters. Those at left apply to through hardened Amola steel and those at right to the case after induction hardening 1037 steel.

hardened axle shaft. This is an Amola alloy steel shaft and a photomicrograph of its transverse section etched in nital to show the quenched and tempered martensite structure, appears at C. At B, Fig. 4, is a photograph of an etched transverse section through the largest diameter of a carbon steel (low carbon martensite case) shaft after induction hardening, as previously described. In the photomicrograph D, is shown the microstructure of the hardened case of the carbon steel shaft after etching in nital.

Bending fatigue of the two axle shafts appears in the graph, Fig. 5, which shows, in the full line, results attained with the induction case hardened SAE 1037 steel and, in the broken line, those for Amola steel (peened), as formerly used.

Effects of temperatures on the static torsional properties of the induction hardened shafts are illustrated in the graphs, Fig. 6.

In the induction hardening machines, Fig. 1, six shafts are loaded by hand in a slightly inclined position against V-blocks that bring the shafts in line with centers. At its lower end, each shaft is set inside a three-turn, water-cooled induction coil and just above a quench ring connected to a water line.

After loading six shafts with taper ends up, the operator presses a start button causing the upper driven centers to lower, contact the shafts and cause them to rotate. At the same time, current at 4800 volts is turned on and 50 kw input is fed to each of the six coils. As soon as the end of each shaft is up to quenching temperature, the whole shaft supporting frame starts to feed down at the rate of 0.258 in. per sec and continues this feed until the entire length

(*Turn to page* 112, *please*)

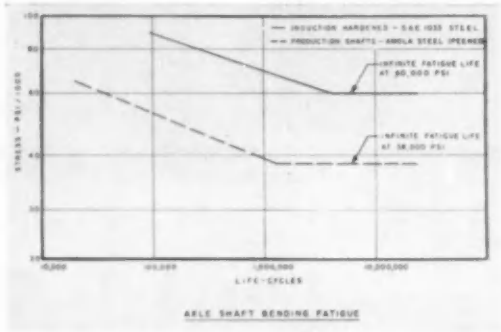


FIG. 5—Graph showing, in the full line, the axle shaft bending fatigue strength of an induction case hardened 1037 carbon steel and in the broken line, of a duplicate shaft of through hardened Amola steel.

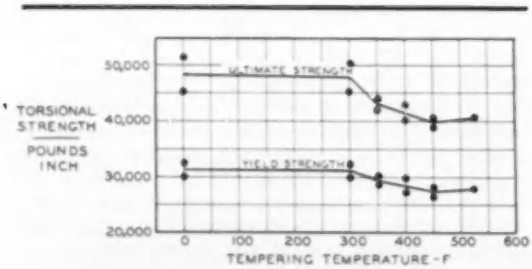


FIG. 6—Relation of ultimate strength and yield strength in static torsion to the temperature at which tempering is done.

AIR FORCE SPECIFICATIONS CLARIFIED *at Diesel Conference*

OIL and gas power for defense was the theme of the twenty-seventh annual conference and exhibit of the Oil and Gas Power Division of the American Society of Mechanical Engineers held in Washington, D. C., last month.

Main discussion topic of the panels and group meetings was the problem of clarifying Government specifications and setting up standards to serve as a base for specifications, so that advances which the industry has made are recognized, and full advantage of such progress can be taken in specifying needs.

One of the important features was the exhibit by suppliers and related organizations. The list of exhibits is constantly growing because each year both the exhibitor and the engineer find that there is mutual benefit in getting better acquainted with the individuals in the business, as well as their products.

Among the highlights of the conference was the "Welcome Luncheon" on Monday, at which the speaker was Vice Admiral Roscoe F. Good, U.S.N., Deputy Chief Naval Operations, Logistics, who talked on "Power Trends in the Navy." He pointed out that the trend to higher power and speeds has created a demand for much better controls and skilled personnel.

Presentation of OGP Citations for outstanding service were made by Rear Admiral W. D. Leggett, Jr., U.S.N. (Retired), vice president, American Locomotive Co., with E. C. Magdeburger, and Hugo H. Haas, both formerly Bureau of Ships, Navy Dept., and Jean Santchi, formerly Nordberg Manufacturing Co., as recipients.

OGP Special Awards for "excellent papers, ably presented," and considered to be distinct contributions to engineering literature, were presented to: Edward A. Sammis, Sperry Gyroscope Co.; J. E. Hart, Kaiser Aluminum and Chemical Corp.; John C. Gibb, Socony Vacuum Oil Co., Inc.; Lewis F. Moody, Jr., Socony Vacuum Oil Co., Inc.; Carlton A. Chamberlain, Clark Bros. Co.; George H. Bollman, Clark Bros. Co.; and T. H. Pofahl, El Paso Natural Gas Co.

Following is an abstract of a paper of interest to manufacturers of Diesel engines:

Air Force Requirements for Diesel Engines

By J. S. Bleymaier
U. S. Air Force, Air Research & Development Command

THE Air Force has requirements for Diesel engines ranging from 30 to 3500 hp. The largest application of Diesel engines in the Air Force is as prime movers for portable engine-generator plants for power generation (60 cycle, 3 phase, 4 wire 120/208 or 254/440 volts). Over 7400 portable Diesel engine-generator plants are in the Air Force inventory, broken down as follows:

Quantity	*Size, kw*	*Engine hp*
1698	15	30
307	20	40
1621	30	55
1620	60	100
1713	100	150
443	150	225

All of these plants are skid mounted. The 150-kw plant is considered to be as large a Diesel-engine power plant as can be considered portable.

The Air Force has become a truly global force, with installations scattered around the circumference of the globe. A common requirement for each of these stations is a completely reliable source of electrical power. Since portability is not a factor, weight is only a minor consideration. Reliability and economy of operation are of primary importance. Based on our experience with slow-speed heavy duty Diesel-electric power plants, the Air Force has established the following speeds as the maximum allowable for stationary plants used for firm sole source power:

Size	*Max. rpm permitted*
90- 100 kw, inc	720
101- 300 kw, inc	600
300-1000 kw, inc	450
1001 and above	360

In addition to the maximum allowable speeds tabulated, Diesel engines or power plants for primary for firm power also must meet the following requirements:

(a) Cylinders of all units must be vertical and in-line.

(b) Engines must be single acting, either two or four cycle, with trunk or crosshead type pistons and a single crankshaft.

(c) Supercharged engines with associated increase in brake mean effective pressure are acceptable; however, the maximum cylinder pressure of the supercharged engine will not exceed that of the same engine normally aspirated by five per cent.

For standby power plants, high-speed, light-duty type engines are acceptable. In other words, the speed criteria given in the table for stationary plants supplying firm power do not apply to standby power plants.

(*Turn to page* 110, *please*)

Budd Saves Time With Plastic Tooling

By Thomas MacNew

A LARGE reinforced-plastics department has been established by the world's largest independent automotive stamping plant — The Budd Co., Philadelphia — for dies, jigs, fixtures, and models utilized in the production of automobiles and railcars. In addition to the various types of tooling, some component parts are manufactured for the Budd RDC railcars.

Philosophy behind the inception of the use of plastics at Budd was the time saved by this method. Regardless of weight or cost, within limitations, the company is most desirous of getting tools to keep its main production lines rolling. A die, for example, made of steel by conventional manufacturing methods requires approximately six weeks for completion whereas a die of reinforced-plastic can be made in about six days using the pattern as a mold. Another major factor is that the company can save the time normally required for die-tryout.

If a stamping is to be run on a mass production basis, the company can tool up with plastics within a week, run the plastic die until its cost can be economically justified and in the interim manufacture a steel die set for the continuance of production with a minimum downtime. Budd not only produces plastic tooling for its captive use, however, but also under outside contract.

Most of the work handled by the rather recently-created plastics department is made up of epoxy resin and, of course, glass fiber. The average piece of tooling produced has five layers of glass cloth, but this will vary dependent on the nature of the tool. A trim skin, for example, will use about 10 layers.

One of the most interesting, and certainly the heaviest (2500 lb) dies made by The Budd Co. to date is a punch for the 1955 model Chrysler station wagon roof panel. This huge punch has an epoxy-glass face with a granite-steel backing.

The male punch was laid up over a plaster mold which had a plastic female siding form secured to it to contain the sides of the plastic male die. After the siding form was targeted and clamped in position, a release agent was sprayed over the entire surface of the mold and siding form. The next step involved putting on 12 layers of 0.010 in. glass cloth and the epoxy resin.

When the epoxy-glass-fiber formulation was set, copper tubing was placed at nine locations to act as air vents between the punch face and the mold for the subsequent operations. Five copper tubes used at each location were imbedded in the underside of the

Start of the Chrysler station wagon roof punch is shown in first step at left. The siding forms have been put in place and a release agent has been sprayed over the entire surface. The female mold was also made of plaster.

Second step (above) shows roof punch with 12 layers of glass cloth and the epoxy resin applied.

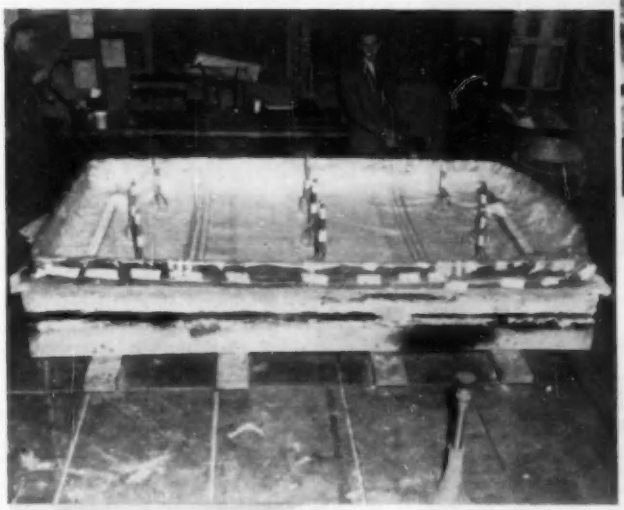
die face and were then bundled to form a vertical stack. Next, the entire surface was covered with a polyvinylchloride sheet. The air vents were, of course, exposed. Main purpose of the vinyl sheeting was to act as a separation media between the die face and the backing material. The two sections had to be separated after initial fabrication because of the shrinkage problem between the different materials utilized.

Next, the backing material of 90 per cent granite and 10 per cent resin was poured into the cavity of the die face. Approximately 50 per cent, by weight, of the backing structure was made up of the granite-resin mix.

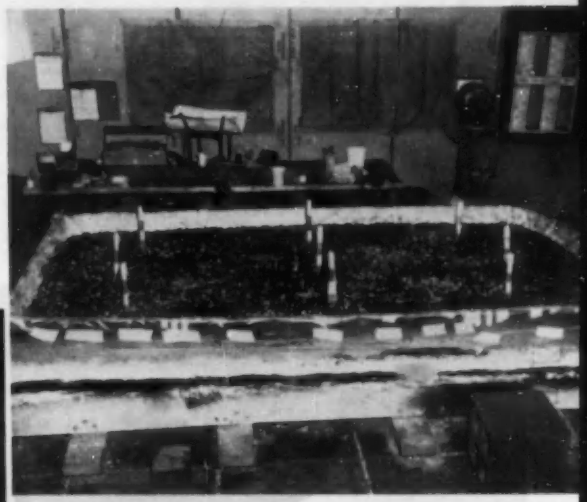
When the backing resin was completely hardened, the unit was removed from the punch face. The polyvinylchloride sheeting was removed from the underside of the die face in preparation for bonding the backing to the face.

After pouring in the required amount of resin for bonding, the granite-resin backing was again placed in the die cavity. A huge steel weldment, which made up the other 50 per cent of the backing weight, was then placed in position on the punch. The volume between the granite-resin base and the steel backing plate was then filled with more of the 90 per cent granite and 10 per cent resin mix. Large steel clamps were then used to force the steel weldment into the mix and secure it there until the material had properly set.

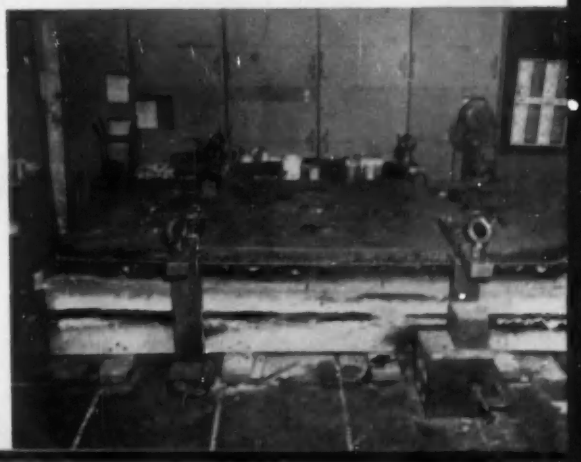
An interesting checking fixture was built by Budd to periodically check Ford assembly body framing bucks in the various Ford branches all over the country. The framing bucks are made of steel tubing and steel castings mounted on a cast iron surface plate. They are rugged in character, but even so they must be checked regularly to insure accuracy of assembly. A light-weight, multiple-section checking fixture was designed of polyester-glass fiber tubing mounted on steel feet. This could be handled in sections by hand, and then attached together by dowel pins to make a strong, accurate and rigid structure for checking each gaging point on the framing buck. Sufficient checking fixtures were made to be stationed in various parts of the country so that each Ford branch could have access to a set quickly. (*Continued on next page*)



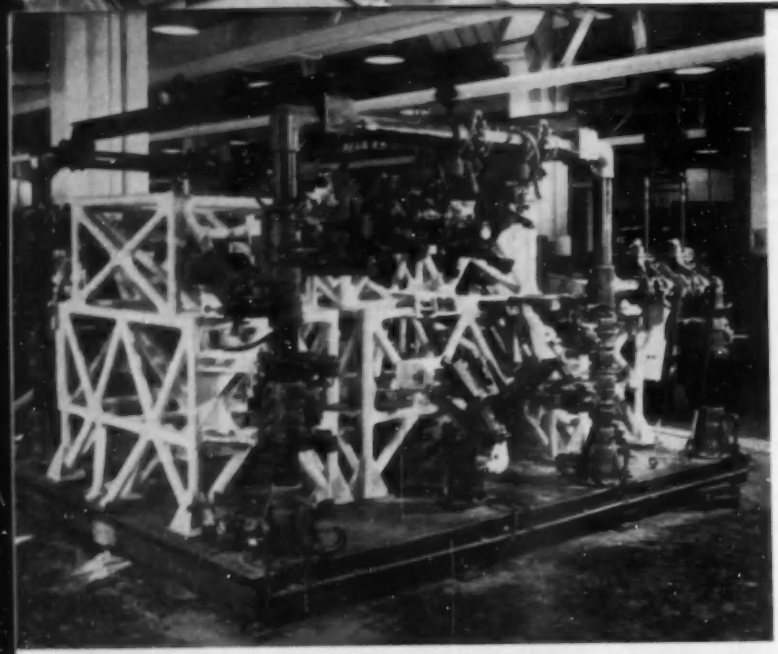
To vent the roof punch, copper tubes were placed in the punch face before the backing material was applied.



Fifty per cent of the backing structure weight consisted of a 10 per cent resin and 90 per cent granite mix.



Final steps included putting the steel backing plate in place and filling in with the resin-granite formulation.



Top—Framing bucks, made of polyester tubing and steel, were sent to six Ford assembly plants as checking masters.

Middle—Floor pan checking fixture.

Bottom — Inner quarter panels for a hardtop were produced with a complete plastic die set.

To make a checking fixture for a passenger car floor pan, Budd utilized the original hardwood model as the male mold. Various engineering changes required in the mold were made with the phenolic resin until the desired dimensions and contours were achieved. For the production of the female fixture, epoxy resin and glass cloth were used for the face contour. Polyester board made up the backing material.

A complete die set — punch, blankholder, and lower die — cast of epoxy resin and glass cloth was used to produce over 6000 inner quarter panels for a hardtop convertible model. A total of 10 layers of glass cloth and a steel base plate were the only reinforcements used for the application. This particular die ran in automated press equipment during the production cycle.

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Mitchell-Bentley Acquires Control of Bolta-Carpart

Purchase of Bolta - Carpart, Inc., Owosso, Mich., by a group headed by Don R. Mitchell, president of Mitchell-Bentley Corp., will enable the latter company to expand its plastic operations substantially. Mitchell's group acquired control of the firm by purchasing outstanding stock held in the company by General Tire & Rubber Co.

Formed in 1952, Bolta-Carpart has been one of the major suppliers of molded plastic parts for a number of industries. Mitchell-Bentley supplies bodies and trim for the automotive industries.

NEW TURBOCHARGED DIESEL

With

Four Valves per Cylinder

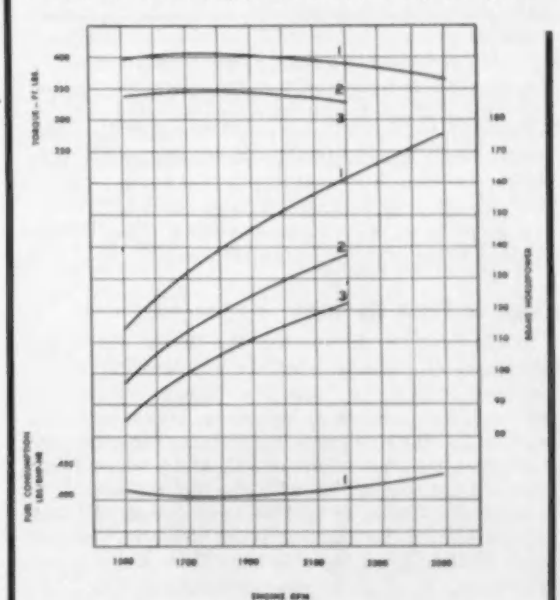
THE new Cummins lightweight 175 hp Turbodiesel engine follows research and design work which was started in 1951 and included the development of the Cummins Diesel race car which competed in the Indianapolis 500 in 1952. The JT-6 has the same basic design and displacement as the race engine which also was supercharged. This six-cylinder, in-line unit has a 4⅛ in. bore, 5 in. stroke, and piston displacement of 401 cu in. Installed in a truck, it weighs 1615 lb, or 9.2 lb per hp.

Turbocharging accounts for the high power available from this small engine. The JT-6 develops 40 per cent more power than the naturally-aspirated model. Performance is further improved by a new four-valve cylinder head design.

Laboratory tests are said to indicate that there will be less decrease in power, compared to naturally-aspirated and mechanically supercharged engines, resulting from a decrease in air density as altitude increases. Tests have not determined a definite point where power begins to drop, but maximum engine power appears to be the same from sea level to altitudes above 5000 ft. The reason is that the turbocharger rotates more rapidly as air pressure decreases. The higher blower speed pumps a larger volume, but approximately the same weight of air as at lower altitudes.

The turbocharger on the JT-6 usually is mounted above the exhaust manifold on the right hand side of the engine. However, mountings for other locations at the rear and side of the engine are available for meeting specific application requirements. Air is piped across the top of the engine to the intake manifold.

The JT-6 Turbodiesel. Note turbocharger mounted above exhaust manifold with pipe for air across top of engine.



Torque, Horsepower, and Fuel Consumption Curves for Model JT-6 Turbodiesel

• • •

SPI Elects Anderson, O'Connell as Officers

At the recent annual meeting of The Society of the Plastics Industry, Inc., Norman Anderson was elected president for the next year. President of General Molded Products, Inc., he succeeds John J. O'Connel. The latter, president of Consolidated Molded Products Corp., is now the new chairman of the SPI board of directors.

GM and Ford Pacts

SMALLER automobile companies and suppliers in the automotive industries naturally have been much concerned since Ford and General Motors signed their three-year pacts with the UAW-CIO. Principal points of alarm are the supplemental unemployment compensation plans and other fairly sizable economic concessions which the contracts embody.

The smaller concerns are, of course, fearful that the union will follow its historic technique of imposing the same basic settlements on them that it wrings from the larger companies. Thus, they are now attempting to appraise the Ford and GM terms in the light of their own economics to determine its impact on them.

Unfortunately, there has been so much publicity about the lay-off pay plan that other features of the settlement, which in total will cost more than the supplemental pay provisions have tended to be obscured. This is natural because of the tremendous build up and public interest in the guaranteed annual wage demand publicized so well by the union for many months prior to negotiations.

Pay Plan Effects Widespread

Both Ford and General Motors acknowledge they are treading on unfamiliar ground with the new supplemental pay plan. Obviously, there are many areas of impact in both the automotive and other industries that are not yet visualized. Two principal results already predicted by some industry observers are higher automobile and truck prices and an even further acceleration toward the employment of automatic machines and processes.

Higher prices of automotive vehicles are considered highly probable when 1956 models appear because of the new pay pacts, not only in the automotive manufacturing field, but also in supplier industries. A substantial increase in steel prices is looked for after current wage negotiations in that industry are concluded. Opinion in Detroit also is that manufacturers will step up their purchases of automated production equipment in an effort to recover some of their costs through better manufacturing efficiency.

Union to Press Its Gains

There is little doubt that the union will make acceptance of some form of the supplemental unemployment principle a "must" in all new contracts it writes in the automotive industries. Consequently, it appears that the only areas in which smaller employers may get some concessions are those in which labor costs are not competitive with the Big Three.

American Motors is said to have already detailed several items in its contract which bring its costs as much as eight to 10 cents an hour above those of the Big Three. It hopes to remove these inequities, but how well it will succeed is still an open question. Chrysler probably will meet the same general contract provisions accepted by Ford and GM when its current agreement ends in August.

Complete GAW Not Achieved

Despite widespread labeling of the supplemental layoff pay plan as a "guaranteed annual wage," the term is actually a misnomer. Even Walter Reuther, UAW-CIO president, does not flatly call it a "guaranteed annual wage." He insists, however, that it is "a start" toward the GAW.

It seems reasonable to assume that the union will be back in three years for much larger weekly benefits of longer duration and considers this year's settlement a "foot in the door" toward its eventual goal of full pay for a full year. However, judging by the adverse reaction from many sections of his own membership, the UAW president may find it difficult three years from now to trade extension of the supplemental lay-off plan for "cash-in-hand" benefits which some members apparently prefer.

Careful analysis shows that the agreement reached with Ford and GM has two highly important features —limited liability and predictable cost over the life of the three-year contract. While all details of the plan are much too complex to list here, it is clear there is no guarantee of maximum, or even minimum, benefits to all workers at all times. Maximum duration is 26 weeks instead of a full year, and the top level of benefits is only 60 to 65 per cent of after-tax pay. Actually, the agreement falls far short of what the union had loudly insisted it would obtain in its original demands.

It even is debatable whether any *totally* new principle was established with the modified supplemental pay plan. Employers have paid the full cost of state unemployment compensation payments all along, so they already had assumed liability for lay-off pay to a certain extent. About the only completely new element is that the amounts and duration of supplemental payments now have been made a matter of negotiation between union and management directly, rather a purely legislative matter.

Roadblocks in Path of Plan

An additional important distinction is that, under state compensation laws, the cost to the employer fluctuates with his unemployment experience, whereas the new supplemental plan is a fixed and predictable maximum cost of five cents an hour. Consequently, during a protracted shutdown, the fund presumably could be exhausted or reduced to a point where bene-

Viewed Warily by Others

Stumbling Blocks Loom Up

By Leonard Westrate

fits no longer are required by the company. Before, that point, of course, benefits to workers would be greatly reduced according to a formula involving benefit credits as related to seniority and size of the fund. Conversely, when the trust fund reaches the maximum—$55 million for Ford and $150 for General Motors—payments by the companies cease.

Actually, the supplemental pay agreement still faces an uncertain future, as it must pass specified legal hurdles before it becomes effective. Rulings first must be obtained that simultaneous payments of planned benefits will not reduce or eliminate state unemployment benefits in states in which the company has two-thirds of its employes.

Originally, it was thought that needed changes in state laws would be no problem, but already there are signs of resistance. The Ohio legislature has killed a bill which would have permitted the supplemental payments without loss or reduction of state benefits and rumblings from other states indicate comparable resistance ahead for similar attempts. If favorable rulings are not obtained before June 1, 1957, the plan terminates.

If that occurs the contract provides that both parties shall negotiate sixty days on disposition of the money that otherwise would be paid unto the plan. If they fail to agree within that period five cents an hour would be added to wage rates across the board for the remaining duration of the contract.

Money already paid into the trust fund does not revert to the company but is vested with the employes and must be paid out in benefits. This probably would take the form of continued supplementary unemployment payments in states where they are allowed as additions to state compensation. In other states it most likely would be disbursed under a plan which would alternate state payments for two weeks with the third week to be paid at triple benefit rates by the company.

The agreement also will not go into effect until the companies have received favorable Federal rulings recognizing that contributions to the fund are income-tax-deductible expenses, that contributions are to be excluded in computations under the Fair Labor Standards Act, and that where applying to employes on defense work, contributions will be allowed as costs in connection with Government contract or sub-contract work.

Assuming such rulings are made, cost of the plan can be considered as a labor expense, along with other concessions granted under the contract settlement. While the union claims the increase totals about 20 cents an hour, neither Ford nor GM has confirmed that figure, and it would appear that the claim is subject to question. Since 6.2 cents of it is accounted for by the improvement factor, of which only 1.2 cents represents an increase from the former rate, the total is more likely about 15 cents, conceding that the union's other figures are correct.

GM, Ford Agreements Compared

Here, in brief, are major similar provisions of the General Motors and Ford contracts:

Duration—Three years, expiring May 31, 1958, for Ford, and May 29, 1958, for General Motors.

Supplemental Pay—Cash benefits up to $25 a week to bring total of state and company benefits to 65 per cent of take-home pay for the first four weeks and 60 per cent thereafter for maximum total of 26 weeks.

Improvement Factor—Increased to 2½ per cent of base pay, or six cents an hour, whichever is higher. Cost-of-living allowance now moves up or down one cent an hour with every 0.5 per cent change in cost

(*Turn to page* 127, *please*)

Credit Units Required to Receive Weekly Supplemental Benefit Under the Ford Set-up. Table Shows How they Will Vary with Changes in the Trust Fund Position

If the Trust Fund Position Applicable to the Benefit week is:	The Credit Units cancelled for such Benefit week payment shall be: Seniority					
	Under 5	5 to 10	10 to 15	15 to 20	20 to 25	25 and over
85% or over	1.00	1.00	1.00	1.00	1.00	1.00
76 - 84%	1.11	1.00	1.00	1.00	1.00	1.00
67 - 75%	1.25	1.11	1.00	1.00	1.00	1.00
58 - 66%	1.43	1.25	1.11	1.00	1.00	1.00
49 - 57%	1.67	1.43	1.25	1.11	1.00	1.00
40 - 48%	2.00	1.67	1.43	1.25	1.11	1.00
31 - 39%	2.50	2.00	1.67	1.43	1.25	1.11
22 - 30%	3.33	2.50	2.00	1.67	1.43	1.25
13 - 21%	5.00	3.33	2.50	2.00	1.67	1.43
4 - 12%	10.00	5.00	3.33	2.50	2.00	1.67
under 4%	No Benefit					

The maximum weekly supplemental benefit to be paid from the Funds will be $25 and the minimum will be $2.

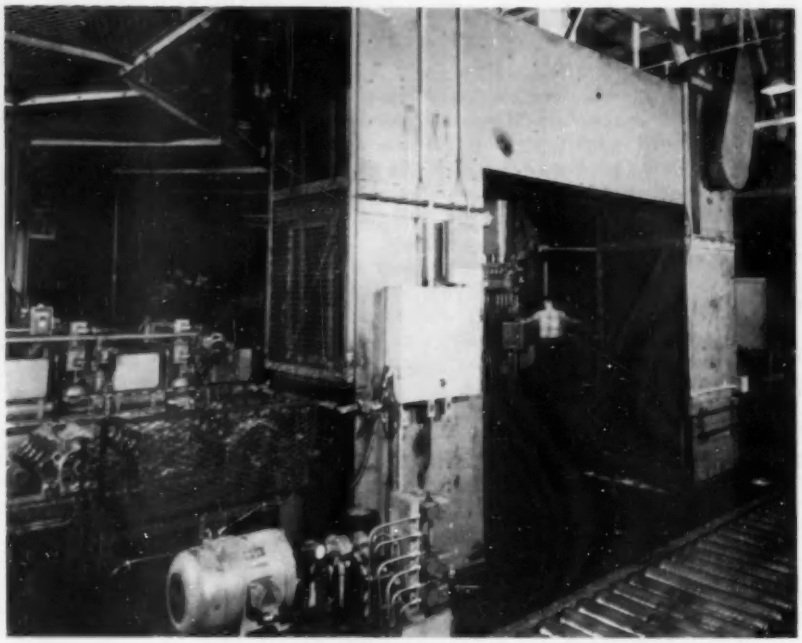
Additional Machining Operations

of Interest at

CHEVROLET V-8 PLANT

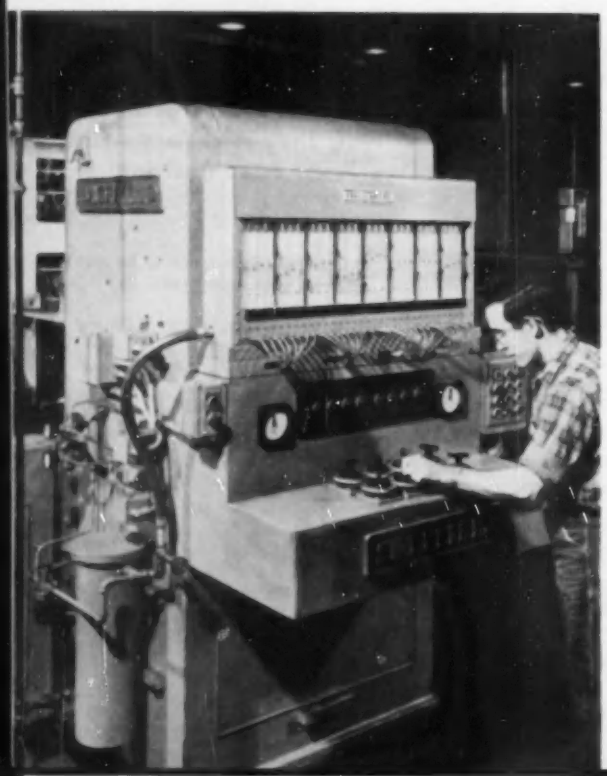
PART III

By Joseph Geschelin



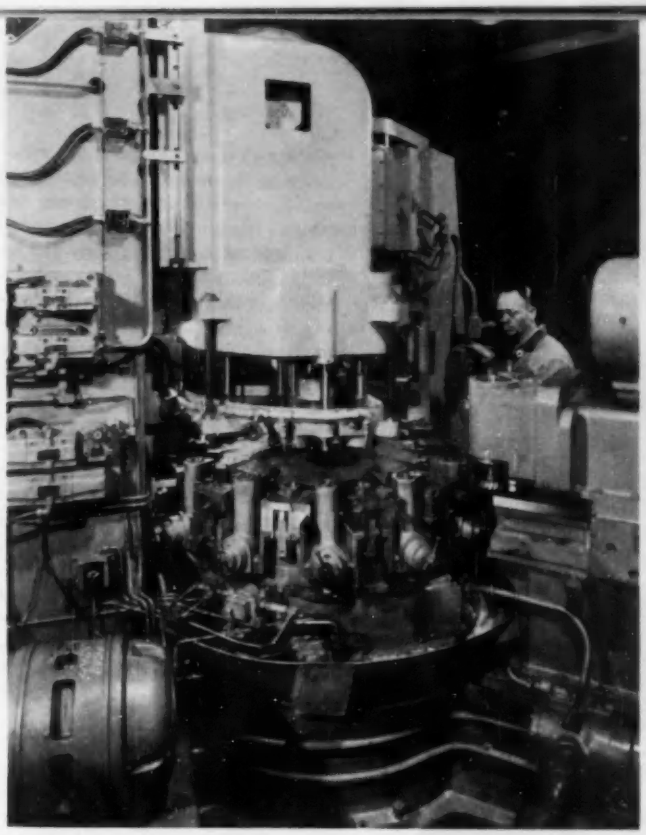
Below is shown operator station of Sheffield Precisionaire gaging machine for cylinder bores. Blocks come into the work station in the rear from Micromatic honing machines at the extreme right, and enter on the conveyor. Gaging of eight bores is done simultaneously. The operator reads each float, sets the dials below, and bore grade then is stamped automatically.

Here is another wrinkle in materials handling. This gate structure spans the aisle between the cylinder block machine line and the hones at the right. Blocks enter, one by one, at the left, are elevated to the cross-over, moved to the right and lowered to the conveyor.



SEVERAL preceding articles dealing with the manufacture of V-8 engines in the new Chevrolet engine plant in Flint touched on the highlights of cylinder block and cylinder head production, covered some of the automation systems and material handling in connection with engine assembly and final balancing (see AI, Jan. 15 and April 15, 1955). The object of this present study is to present additional highlights of miscellaneous operations supplementing those already placed on the record.

Kearney & Trecker has provided some interesting, fully automatic, multiple-station equipment for initial operations on crankshafts and camshafts. Although these machines are simple and compact in appearance, they perform in a rapid cycle operations that formerly required a number of large pieces of equipment. Typical of the machines in the crankshaft line is the three station, automatic cycle unit, illustrated here. The first station mills crank-



Close-up of the multiple-head Michigan Drill Head machine tooled for completely machining oil pump bodies.

shafts to length, centers at the second position, and mills a number of locating and clamping spots on counterweights at the third. Milling at the last station is done dry and at high speed with gratifying tool life, according to the management.

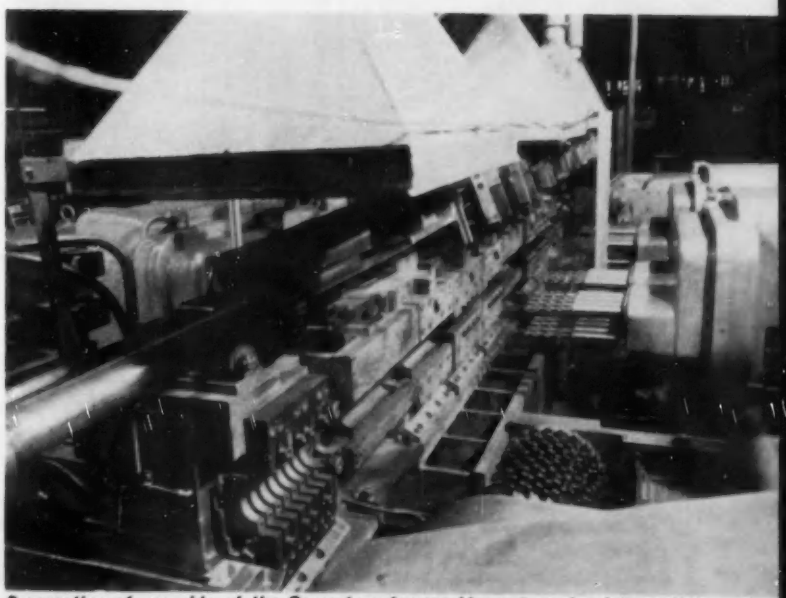
The central fixture is of four-station type, with one station for loading and unloading. It is of interest that at each operation the machine head moves into and out of position over the work through an automatic shuttle cycle.

Kearney & Trecker units on the camshaft lines are somewhat similar in appearance and function, except for differences in detail. These too are of three station type. However, they handle two camshafts at a time at each position. The first station, provided with combination milling cutters on each side, mills the work to length, then cuts a deep groove in the end bearing with the smaller diameter cutter. The second station centers both ends; while the third position has a horizontal drill head for drilling of two holes in one end.

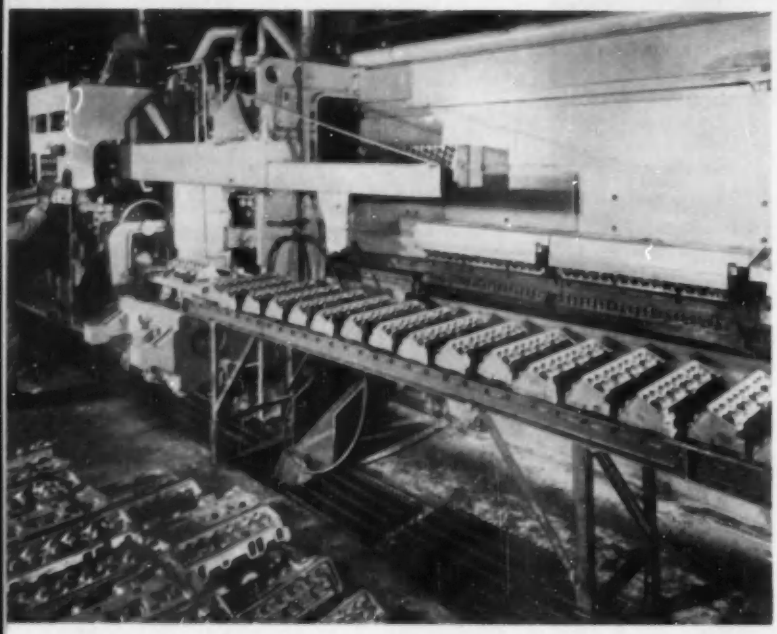
A larger battery of Michigan Shear Speed machines has been installed for cutting gear teeth on oil pump gears as well as large sprockets. Not only is the operating cycle extremely fast, it also is claimed that this process produces excellent control of tooth spacing and profile as well as outstanding surface finish. These desirable characteristics are particularly effective in the case of sprockets where tooth spacing and surface finish are of primary importance.

Some interesting multiple-head, multiple-spindle equipment for a variety of parts has been introduced by Michigan Drill Head. Characteristic of these is the large machine, illustrated here, for handling all operations on the oil pump body in a single setting. In addition to drilling and reaming of various holes and bores, the machine also produces the cavity for the two mating gears, holding depth to a total tolerance of 0.002 in. In addition, one station mills the parting line, producing a surface sufficiently flat and smooth to permit making up a leak-proof assembly without the usual gasket.

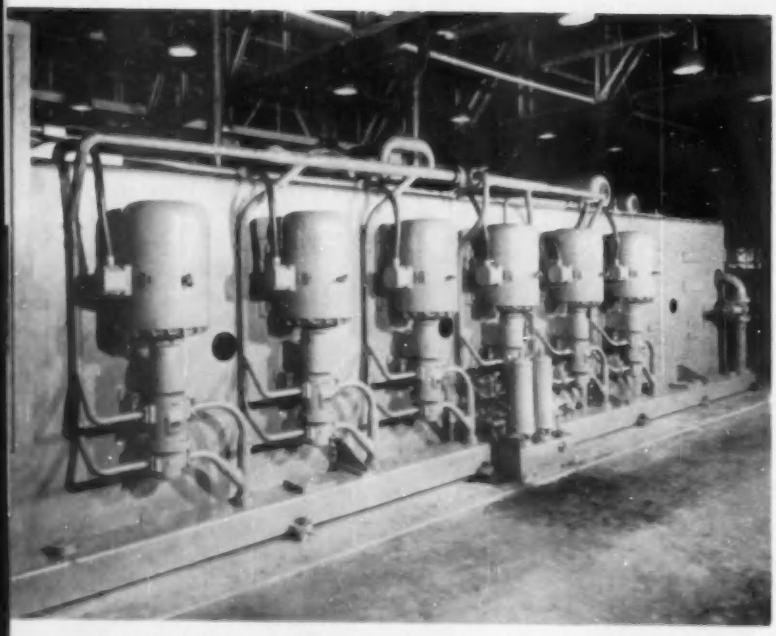
It may be of interest at this juncture to point out that all of the equipment mentioned in this article is hydraulically operated. Chevrolet has made it a practice to insist upon hydraulic actuation because experience over many years has demonstrated—insofar as Chevrolet



Perspective of one side of the Cross transfer machine set up for intermediate main bearings. The work station at the right in the foreground is the multiple sawing operation that parts the eight sections.



Perspective of recently installed Cincinnati horizontal surface broaching machine for cylinder heads.



Rear of Cincinnati cylinder head broaching machine, showing the vertical mounting of the six, 50-hp motor drives for hydraulic ram actuation. Note worthy is the simple and clean mounting of motors and Vickers pumps wit their connections to the manifolding.

is concerned—that such equipment is conducive to low maintenance costs.

One of the interesting items of automation on the piston machining line is the Morris piston balancing equipment seen in the illustration. As pistons enter the first station they are weighed automatically to determine the amount of metal to be removed from the weight bosses. This information is transmitted to the milling station where the bosses are suitably milled as they enter the second station. Leaving this station, the piston is flipped over to present the open side and reweighed at the last position. The entire sequence of events is fully automatic, does not require operator attention. Incidentally, it is so sensitive in action that pistons are balanced to equal weight to all intents, plus or minus two grams.

We mentioned in an earlier installment the automatic Sheffield Precisionaire gaging machine for grading bores from the final honing operation. These machines now are in the line and in use. Blocks enter the machine on a conveyor and are engaged by the gaging members in all eight cylinders simultaneously. The photograph shows the outside of the machine at which the operator is stationed. He notes the grade for each block, then turns each knob to the grade number, thereupon initiating the final cycle of stamping the proper bore grade for each bore. As mentioned earlier, the grades are graduated in steps of 0.0002 in.

An additional unit of automatic equipment, recently completed, has the appearance of a rectangular gate spanning the aisle at the end of the cylinder block machine line. As cylinder blocks come off the end of the machine line, they enter the automation device at the left, are suitably engaged, are elevated and transported to the vertical elevator at the right where they are lowered onto the conveyor line. The cycle is automatic and intermittent, moving one block at a time. What it does actually is to transport blocks automatically from the machine line to the honing stations without blocking the main aisle.

Mention was made earlier of the enormous horizontal Cincinnati surface broaching machines installed on the cylinder block line. This equipment has the same physical appearance and, in fact, the same basic frame as the cylinder case machines. The difference lies

in the detail of the ram, broaching tools, work handling fixtures, and in the amount of power required for ram actuation. It will be recalled that cylinder block broaching required 550-hp for hydraulic actuation. Cylinder head broaching, on the other hand, takes 300-hp, using six large vertically-mounted motors as shown. Noteworthy, too, is that all hydraulic equipment for these surface broaching machines is supplied by Vickers.

Consider now some additional transfer equipment. One of the interesting and compact lines is the Cross Transfer-matic arrangement for completely finishing main bearings in an automatic cycle. These are two parallel lines of Cross Transfer-matics, one for intermediate bearings, the other for rear bearings. Unusual feature is that sets of eight intermediate bearings are cast enbloc and processed through the line, finishing two engine sets at a time. In the case of rear bearings, they handle three at a time, thus producing enough for three engines in each cycle.

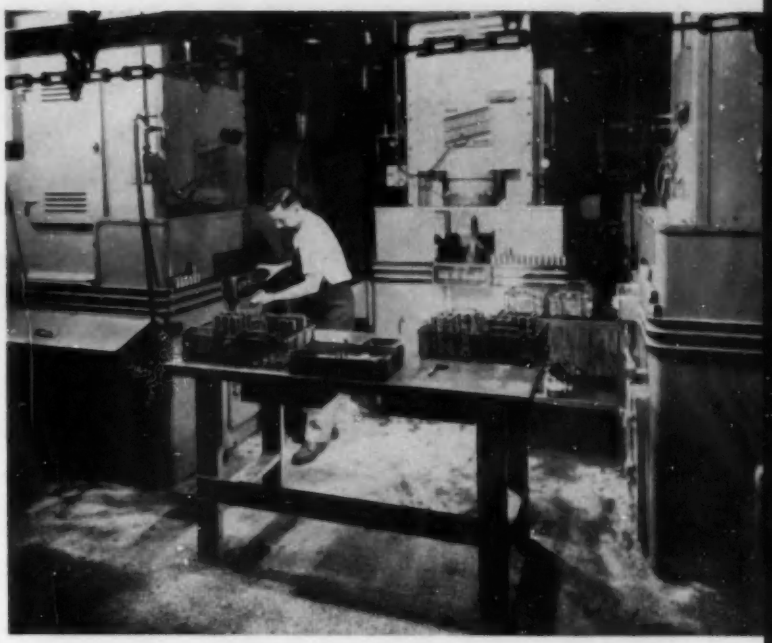
Both machines are served by a single horizontal Cincinnati surface broaching unit of two-station type. The first station completes the half-bore, parting edge faces, and chamfer. The second station broaches the bolt bosses. Both types of bearing blocks go through the same machine without change in fixturing or tooling. This marks an excellent example of how engineering design and manufacturing procedures dovetail at Chevrolet. In this instance, interchangeability of tooling is facilitated by proper initial attention to the form and size of different parts.

In the case of the rear main bearing—the larger and more intricately-machined piece of the two—the entire operation from start to finish is handled in a 19-station Cross machine. The sequence of operations is as follows: notch three anchor slots and mill four slots; drill six holes; drill 12 holes; chamfer three holes, ream three holes; drill three holes, ream six holes, chamfer three holes; rough-mill three oil seal grooves and three slinger grooves; tap three holes; drill three holes ½ depth; drill same holes ⅔ depth; drill same holes through; part caps.

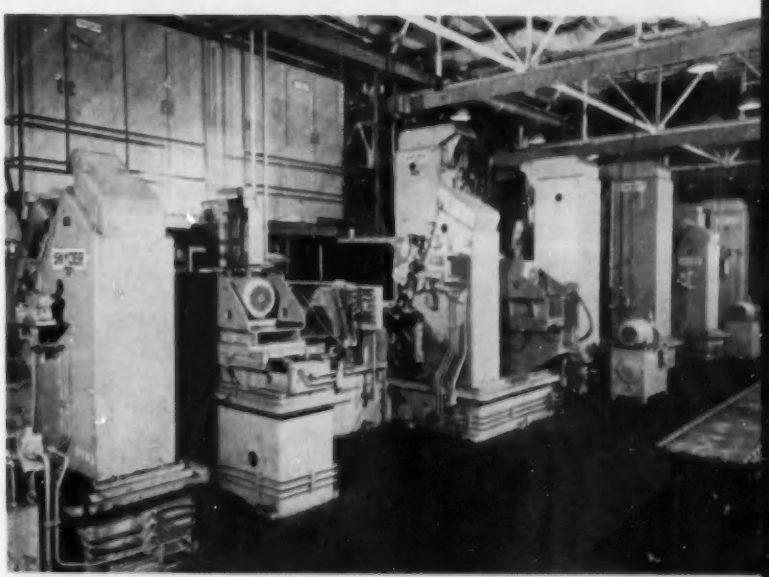
In addition, the seal wick groove is finish-turned in a separate setting in a six-spindle Bullard Contin-U-Matic lathe.

Intake manifolds, another of the parts requiring considerable processing, are first broached, then finished completely in special Snyder transfer machines. Chevrolet manufactures two types of V-8 engine intake manifolds—one for two-barrel carburetors; the other for the four-barrel power package.

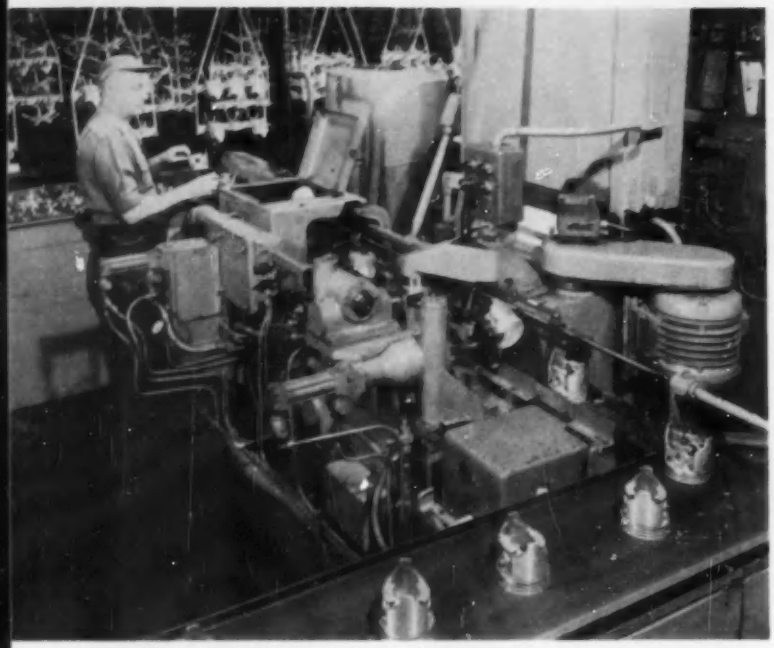
In preparation for machining,



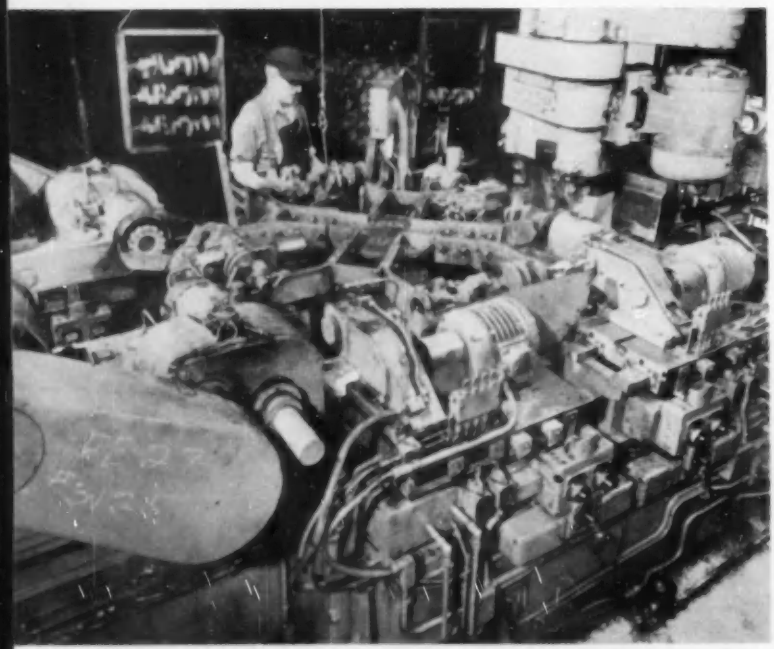
A group of three Michigan Shear Speed gear shapers cutting oil pump gears.



View of portion of the Snyder transfer machine line for intake manifolds. Note the large electrical control cabinets mounted overhead in the background.



Automaticity is feature of the Morris piston balancing equipment seen here. Pistons enter the first station at the extreme left, where they are weighed and the reading automatically transmitted to the weight-milling station in the center. Upon entering the latter station, they are milled to weight to a tolerance of plus or minus two grams. Leaving this station, pistons are flipped over to present the open end for the next operation.



One of the special Kearney & Trecker combination milling and drilling machines on the crankshaft line. Shafts are milled to length on the station at the left rear. Centered at the second station — right rear. Drilled at the double-end station in the foreground.

the manifolds first are routed to a 125-in. horizontal, 20-ton Cincinnati surface broaching machine of two-station design. Here the bank surfaces—port faces—are finish-broached, one manifold per stroke each way, the operator loading one station after each stroke.

In machining, the company has one 22-station Snyder machine tooled exclusively for two-barrel carburetor manifolds; and two, 27-station Snyder transfer machines capable of handling either one without change of tooling, except for idling certain stations.

Work enters with port faces up for drilling of 10 holes and reaming two holes; milling bottom surfaces on both ends; drilling four holes. At Station 7 it enters a turnover fixture to present the top surface to succeeding operations as well as to remove chips. From this point on all succeeding machine stations have the heads placed on an angle of four degrees to the horizontal axis, to accommodate the angularity of the upper surface.

First operation at this stage is facing of the carburetor mounting boss and water outlet boss. This is followed by drilling of 14 holes; core-drilling three holes; counterboring one and drilling one; drilling five and counterboring one; and a similar sequence of drilling, reaming, countersinking, and tapping a large number of holes in succeeding stages. Altogether the operation on the two-barrel manifold requires a total of 90 spindles in action without counting those for facing operations.

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Florida Test Service Expands Its Equipment and Facilities

The South Florida Test Service, located adjacent to Miami, Fla., has added a new laboratory building to its main inland proving grounds, laboratory, and office buildings. It also plans to open an auxiliary test field later this year.

The organization specializes for the most part in tests and research related to the climatic conditions of southern Florida. It serves leading companies of the automotive and aviation industries, and is contractor to the Air Force.

DELIVERY TRUCK BODY of All-Plastics Construction

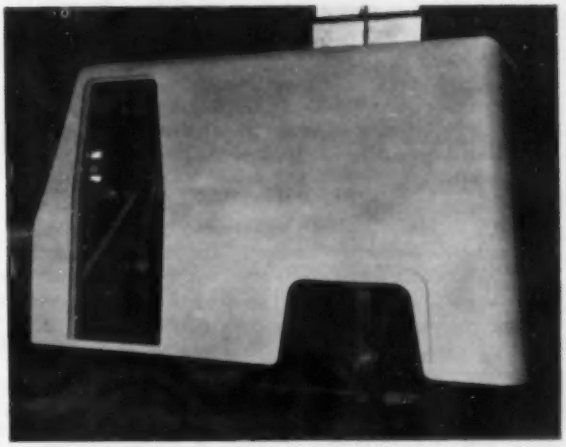
Complete body assembled on chassis

A MILK delivery truck body in which top, bottom, sides, and interior lining are made of a polyester-glass fiber laminate has been completed by Strick Co., Philadelphia, as a pilot model for Carnation Milk Co. of Los Angeles. Like several other large delivery truck users, Carnation is interested in the possible economies to be obtained by use of the new construction and material.

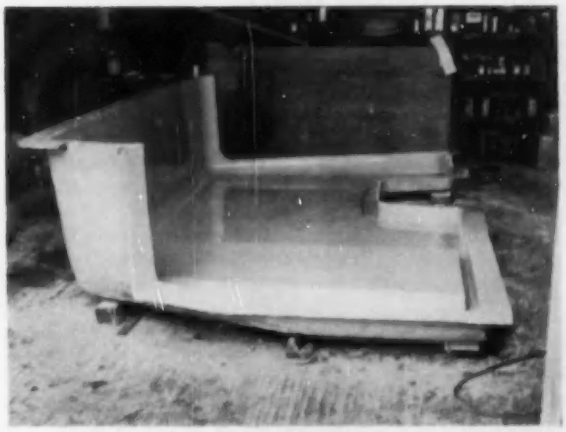
Design of the delivery truck is unusual in that the body is produced as two large moldings, with framing and fender well integral with the skin. The two moldings are joined by a Neoprene synthetic rubber gasket. This construction greatly reduces the number of parts to be assembled, and also reduces the number of metal fasteners, bolts or rivets, required. Expected results are a quieter body and better refrigeration through elimination of many metal conductors.

A wrap-around windshield and smooth modern lines are obtained by the molded construction. The body is mounted on a Ford chassis.

The master molds for the body were made in wood, and plastics female molds were made from these. The actual moldings were made in these female molds. The colors required for this first body—white with green and red decoration—were obtained by painting the finished truck body, but colors could be produced by impregnation of the resin at the time of molding. The interior of the load compartment, where service is the most severe, was made up of unpainted laminate with a white pigment incorporated into it.



Trimmed molding which forms one side of body



Plastics final mold

High Spots of the SAE Summer Meeting

By Paul Kennedy

MATERIALS, fuels, greases and transmissions received feature treatment at the Golden Anniversary Summer Meeting of the Society of Automotive Engineers. Representatives from several industries gathered in Atlantic City, N. J., last month to trade views on a variety of subjects, several quite controversial.

While the wave of major new developments of a year ago has abated somewhat, still there was lively interest shown in the latest trends in lubrication, suspensions, cooling, and research techniques. Among innovations for 1956 mentioned in meetings were 13-psi pressurized cooling systems, a workable anti-noise program for truckers, and 9.5-to-1 compression ratio for some engines.

Truck operators expressed their favorable opinion of automatic transmissions in heavy-duty trucks, based on experience of lower maintenance costs and enthusiastic reception by drivers.

CASTING, PLATING PROCESSES

Panels on materials for the future brought to light several new developments. Harry Hamjian described the program at Utica Drop Forge and Tool Corp. for vacuum melting. A 1000-lb furnace with centrifugal casting equipment now is used in production of jet engine blades. Besides allowing scrap to be reused, the process was proved to give improved ductility and strength to such alloys as Waspaloy and Nimonic 90.

Progress at the Wisconsin Foundry, Inc., in developing centrifugal casting of titanium alloys was described by its president, M. E. Nevins. He predicted limited commercial use of titanium in the immediate future with consumption now leveled off.

Vacuum metallizing of automotive decorative parts was reported by J. G. Seiter, F. J. Stokes Machine Co. The process is said to have been improved so in two years, with the use of synthetic resins and Epon lacquers, that exceptional resistance to abrasion, salt spray and humidity is provided. Usually aluminum is vaporized off of tungsten filaments, plating to five-millionths in. Lacquer is then flow-coated on and baked. Seiter estimated equipment and production costs in his paper. Transparent plastic sheeting is receiving considerable attention lately, he said.

JET FUELS, GREASES

Jet aircraft fuel, type JP-5, soon will be delivered to the Air Force for evaluation. D. P. Heath of Socony Mobil Oil Co. told how a new hydrocracking process makes this fuel more stable at 400 to 500 F, a critical requirement at this time. Dr. C. M. Barringer of Du Pont suggested that present JP-4 fuels could be made acceptably stable with additives. Shell Development Co. engineers found that storage life of JP-4 can be improved with acid treatment and hydrogenation and by restricting contact with oxygen from air. A testing setup for predicting thermal stability of fuels was illustrated by Esso Research and Engineering Co. engineers.

A lengthy symposium on automotive greases brought together grease chemists and automotive engineers, perhaps for the first time in recent years. Grease manufacturers, said spokesmen from the floor, are surprised to learn they should be responsible for riding qualities, as well as for lubrication and exclusion of dirt and water. Pros and cons of automatic lubricating systems were discussed by C. H. Mueller of Lincoln Engineering Co. and L. J. Kehoe, Jr., of General Motors Corp., respectively. Multipurpose greases, such as rheopectic lubricants—oils which solidify upon flow—were suggested by several speakers. Defending present greases, one commentator questioned the practice of designing chassis on the basis of performance of grease just after lubrication, rather than after 10 miles or more of driving when properties have leveled off for the next 1000 miles or so.

CORROSION

An analysis of present anti-corrosion tests for body steel was presented by J. C. Holzworth, R. F. Thomson and A. L. Bolgehold of General Motors Research, complete with color illustrations of rust formations. Data on protective coatings and special steels for high temperature strength and rust resistance were presented by H. J. Noble and W. H. Sharp of Pratt & Whitney Div., United Aircraft Corp.

SUSPENSION, TIRES

Basic changes in suspension systems are long overdue. So said F. R. McFarland of Packard, in illustrating the new Torsion-Level system. R. H. Isbrandt of American Motors and R. N. Janeway of Chrysler Engineering commented that the shock absorbers required for this system appeared to give excessive damping. Janeway remarked that long wave-length bumps might create an undersirable pitching force,

due to the center of pitching being in the center of the car. McFarland said this wasn't objectionable and also explained that no fretting corrosion was found on the hex splines of the torsion bars. They are relatively soft, he said—Rockwell C 25—and seem to imbed in the anchor.

Ride analysis methods, analytical, observational, and experimental, were discussed by A. C. Bodeau of Ford.

Tires generally can dissipate about 10 hp of heat, at about 94 mph, according to a rule of thumb observed by E. H. Wallace and S. A. Lippmann of U. S. Rubber Co. Robert Schilling of General Motors Research commented that two tire properties need investigation: correlation between testing on the road and on a drum, and the effect of wheel hop vs. rolling radius of the tire in regard to fore and aft car shake.

MANUFACTURING RESEARCH

This branch of research is the step-child, apparently. K. W. Stalker of General Electric Co., the panel leader, said less than five per cent of the $4 billion spent last year for all research was used for this phase. Joseph Crawford introduced a new Milling Setup Calculator soon to be put out by Cincinnati Milling Machine Co. Discussion by W. M. Williams of Thompson Products indicated a Foote-Burt continuous chain broach with carbide tips gives ½ million pieces per grind on powdered metal jet engine blades, for only 20 per cent of the cost of other types of equipment. Utica Drop Forge and Tool Co. found die life increased and cost reduced by using an electric resistance upsetting machine for making blades. Ex-Cell-O, said Louis Zimmel, went through four unsuccessful processes before finding the present way of making blades on a thread grinder. They use circular cams of a unique type. The blade is milled as it and the cam rotate about their respective centers of gravity.

COOLING

Low-speed cooling in 1956 will call for stabilization for a minimum of 30 minutes at idle, in 100 F air after a 70 mph run, even with air conditioning. So said H. A. Reynolds of Harrison Radiator Div. of GM. L. L. Hunt of McCord Corp. predicted 1956 radiators will stabilize even in 105 F air if they have a 13 psi pressure cap. Several panel members agreed that a fan disconnect is needed for trucks especially, which will engage slowly and smoothly under load, to prevent lugging the engine dangerously.

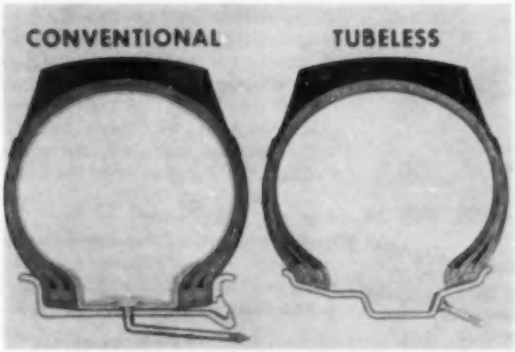
Drop Center Rim for Tubeless Truck Tires

By T. A. Robertson and R. P. Powers
Firestone Tire & Rubber Co.

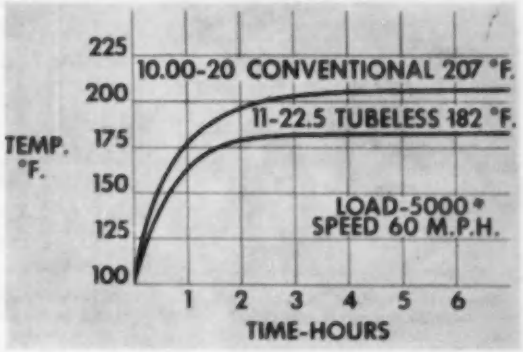
DUE to their larger size and greater stiffness, truck tires of 8, 10 and 12 plies have had to be used on rims with removable flanges. Such a rim obviously cannot be airtight without some special modification. Either the rim parts must be sealed in some manner or a new type of one piece rim designed which will accommodate a tubeless truck tire in a simple and effective manner. It was this requirement which led to the development of the new drop center tubeless truck tire and rim.

Several years ago, our company investigated a new type of rim in which the tire beads were held on the rim by a wedge effect, the flanges being only high enough to center the beads. Originally this was done to get a more flexible, durable tire — one in which the cords did not have to bend over the conventional high flanges when the tire was deflected. It provided, as hoped, a more flexible, durable tire but these advantages alone were not believed sufficient to justify a completely new tire and rim. In the course of the investigation it was found that such a truck tire could be mounted on a one piece, drop center rim, just like a passenger car tire. This fact opened the way to the new, modern truck tire — tubeless and capable of being mounted on the simple one piece drop center rim.

The present conventional tire, tube and flap assembly mounted on a conventional three piece rim is supported almost entirely by the high rim flanges which also serve to hold the beads against the side forces due to inflation. Originally these rims were perfectly flat across the base with



Conventional truck tire and tube compared with drop center tubeless type



Comparison of running temperature at 60 mph for conventional and drop center tubeless truck tire

clearance provided for mounting the tire. More recent designs incorporate a 5-deg taper under the heel of the bead which serves to center the tire and reduce rocking under load.

The new tubeless tire itself is similar to the conventional tire except that it has an airtight innerliner as an integral part of the tire. This replaces the conventional tube and flap. The tire bead surface is also made airtight to provide a seal between the tire and the rim. The tire bead fit on the rim is quite different from the conventional assembly and a well is provided in the center of the one piece rim so that the tire can be buttoned over during mounting.

In designing the fit of the new tire on the rim we are putting all of the base of the bead to work. The seat on the rim has a very high angle—15 deg. The tire is molded much smaller than the rim and is forced up very tightly onto the tapered rim seat by the inflation pressure. Since the forced taper fit on the base of the bead carries most of the side load it is possible to use a much lower flange. The flange itself functions mainly as a centering member.

With the high taper low flange type of mounting the cords of the tire body are no longer subjected to an abrupt change in direction at the point where the tire leaves the rim. Stresses in the lower sidewall region of the tire are reduced and it is possible to use a less bulky bead construction. This means greater flexibility in the lower sidewall region of the tire which gives improved ride and an increased resistance to flex fatigue in the tire body cords.

The forced taper fit mounting has two other important advantages for tubeless application. First, of course, is the extremely tight seal against air leakage. Second, is that the high taper makes it easier to break the bead loose during dismounting of the tire. This is important to avoid damage which might be inflicted on these air sealing surfaces by tire tools.

Three Piece Rim for Tubeless Truck Tires

By C. R. Case
Goodyear Tire and Rubber Co.

THE change from tube-in-case to tubeless for proven passenger car and light truck service was accomplished by simply adding the tubeless feature to an already proven tire construction—with no basic change in the shape or dimensions, or structure of the tire, and no change in the basic rim design.

Back in 1952 and 1953 sealing gaskets had been used for many other purposes, but not for confining air pressure in pneumatic tires. Steady progress was made in this direction, so that by the early part of 1954, it was an established fact that such a gasket, when made of proper materials and suitably confined between two metal surfaces, was an entirely satisfactory air container.

A review of other types of tubeless tires shows that each has several things in common:

a. A five-deg taper bead seat.

b. Full, and uniform, compression and support across the entire base of the bead.

c. A reasonable and quite uniform relationship of flange height to total tire section height. Such a relationship has been uniformly successful regardless of the type of tire, or the type of service involved.

d. Full support of the bead by the rim flange, a basic feature of all straight-side tire design ever since that type replaced the early unsatisfactory "clincher" many years ago.

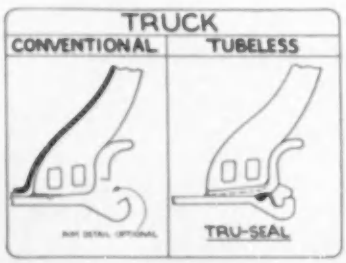
e. The same section height and the same length of sidewall and flexing zone as the present regular conventional tire.

f. The same section width as the present regular conventional tire, which further insures no change in the load-carrying ability.

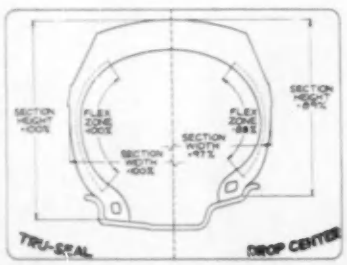
With the experience on sealing gaskets in tubeless earthmover and airplane tires as a background, it was obviously desirable to follow the same line of reasoning in the development of a regular truck rim. This has now been accomplished in the Goodyear Tru-Seal rim design. This design requires only a very small change in the diameter of the regular present-day truck rim. The difference is actually confined to an increase of only ¼ in. on diameter, or ⅛ in. in total tire height. This small change is necessary to maintain the present inside dimensions of the rim, plus providing full support across the base of the bead, plus the space necessary to properly locate the sealing ring.

There is, therefore, in the Tru-Seal program no cause for concern or debate, as to how general performance or ultimate durability may be affected by basic changes, or compromises, such as those which are necessary in the drop-center approach to this problem. We refer here to such things as the use of a fundamentally smaller tire, with an average reduction of 11 per cent in section height and three per cent in section width, together with a shorter flexing zone and a complete change in the bead structure, all of which have their effect on the general behavior and ultimate performance of the tire. The Tru-Seal rim now gives to regular truck tires full and continuous support to the entire surface of a five deg taper bead.

Complete adaptability to existing disk and cast wheels is provided. There is no need for any deeper, stronger, or more expensive disk or for special or costly adapters to permit application to cast wheels. Maximum ease and simplicity of mounting and dismounting is offered regardless of rim diameter or type of bead construction.



Goodyear Tru-Seal tubeless truck rim design vs conventional



Dimension comparison of Tru-Seal (same as for conventional tire) with drop center tubeless type tire

Practical Tire Research

By V. E. Gough
Dunlop Research Centre
Dunlop Rubber Co., Ltd.

A PLAUSIBLE mechanism as to how a tire develops a cornering force is that a tire lays its tread down along its line of progress (which is at an angle to the plane of the wheel), and the tread remains (because of the friction) on the point on the ground at which it was laid until the end of the contact when the fall in contacting force allows the elastic forces in the casing (set up by the distortion) to return the tread to the plane of the wheel. A device records lateral movement and force within the tire-ground contact under a tire rolling at a slip angle.

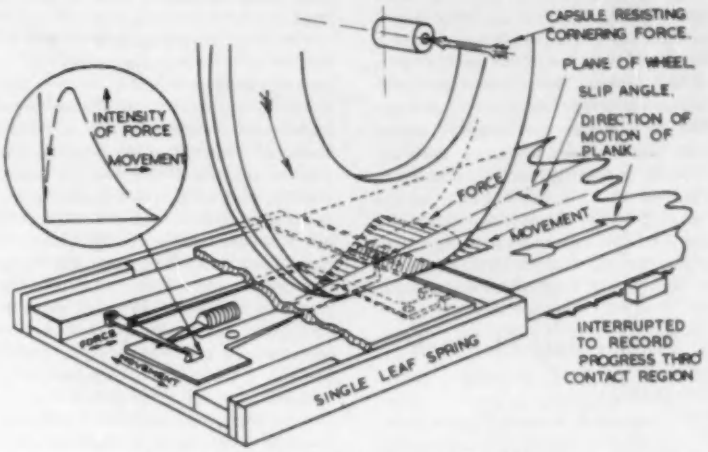
A one-inch square bar whose top face is flush with the top surface of the plank, is carried by two single leaf springs, one each end of the bar. The edgewise stiffness of the springs is sufficient to eliminate the downward deflection of the bar while the lateral stiffness is such that a small deflection arises when a sideway force acts on the bar. This small deflection is magnified by a lever, which causes a stylus to trace a diagram on a smoked glass plate which in turn is moved in a direction at right angles by a spike which passes through a slot in the bar into the tire tread. The diagram produced is then the intensity of sideway force against sideway movement. The location through the contact patch is obtained by electromagnetically lifting the stylus every inch of progress of the axle.

At any significant slip angle the tire movements on the ground are primarily lateral and all ribs move a similar amount. The small departures from this do not invalidate the apparatus. At zero slip angle the movements are more complex and are different for different ribs, but are all trivial compared with the general lateral movement which occurs in a cornering tire, but even at half degree slip angle the lateral movements are predominant.

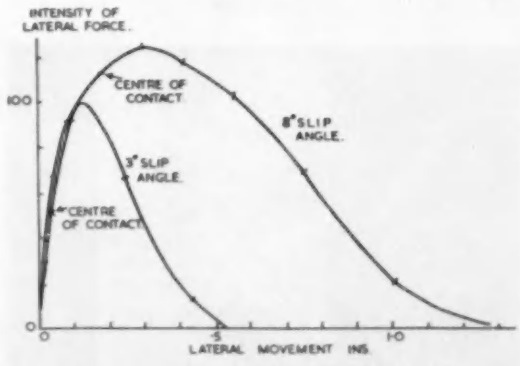
We must agree that understeer and oversteer relate to the state of stability of motion of the vehicle. It is not generally realized that equality of front and rear slip angles only corresponds precisely to neutral steer on straight paths. This caused Hardman to re-define neutral steering in terms of the effects of side force on the radius of the vehicle's path. The difference between the definitions is small in practical cases and for many analyses unimportant. Its presence must be borne in mind in more advanced studies in stability, which will surely come in due course.

There will be two kinds of studies, those of the stability of the vehicle with locked steering and those of the stability with a human driver.

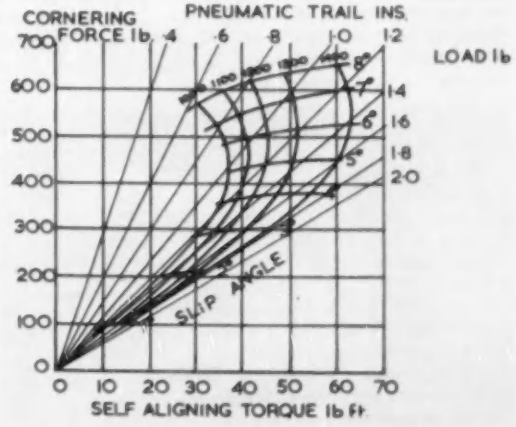
Both studies will need tire data. We have found that the use of what we call the Characteristic Curve to be of considerable help to us. This curve



Apparatus for study of tire ground lateral forces



Force movement at high and low slip angles



Characteristic curve of 7:60-15 tire at 24 psi

is a plot of cornering force against aligning torque for a series of loads and slip angles. It is in effect a plot of what the driver applies — aligning torque against what he gets — cornering force. The relegation of the slip angle to a subsidiary role is justified because the driver never knows the front tire slip angle. It does not prevent cornering power from being read off as it is the ordinate of the curve for the given load and slip angle. The sloping straight lines allow the pneumatic trail or castor or offset to be read off directly.

Buick's Variable Pitch

By R. J. Gorsky
Buick Motor Div.
General Motors Corp.

IN 1955, the converter design was revised to incorporate variable pitch stator vanes instead of fixed stator vanes. The two turbines are intereconnected in the same manner as in the Twin Turbine Dynaflow.

The stator blade carrier assembly is composed of two sections made of shell molded cast iron. These sections are partially machined, dowelled, and bolted together before they are finish-machined as an assembly. This provides castings with minimum weight, sound wall sections, and a coefficient of expansion nearly the same as the steel shaft upon which it is mounted. Close fitting steel backed bronze bushings are used at this location, which omits the necessity of cast iron oil sealing rings. These castings are machined all over, removing 0.030-0.045 in. for rough cuts and 0.015-0.020 in. for finish cuts. The weight decrease of these two castings during machining is 38 per cent. This can be compared to the weight decrease of the sand cast high clutch drum during machining which is 54 per cent. The premium price paid for the shell molded castings is more than offset by the saving in machining.

The stator crank holes are drilled and reamed to a tolerance of 0.002 in. and their centerline is on the parting line of the two carrier sections. A close hole tolerance is required to minimize oil leakage past the crank bearings and the centerline parting permits the usage of a crank and blade sub-assembly.

The stator piston or crank actuator is a sintered powdered iron part. Labyrinth grooves are machined on the ID to provide oil sealing, and a groove is turned on the OD to accommodate a cast iron oil seal ring. The weight decrease of this part during machining amounts to only 23 per cent.

The outer ring or shroud is a sheet metal stamping. First, a cup is formed from which the bottom and draw flange is trimmed off, leaving a cylinder of seamless tubing. The cylinder is then fit over a plug and pressed axially between form controlling dies. This causes the center section to first bulge out, and then get squeezed together forming a very rigid T section. The holes which accommodate the outer ends of the cranks are pierced in a radial outward direction so that a smooth surface will be retained on the ID for the stator blade to seat against. No machining is done on this part. A die casting was initially considered for this part until a cost analysis showed it to be approximately three times as expensive.

The stator blade crank is made from close diameter tolerance SAE 1018 cold drawn wire of 0.1540-0.1550 in. diameter. This wire is fed in to a stop in a four slide machine. One slide forms the crank-throw; another squeezes the crank to reduce its thickness, and the part is cut off by the fourth slide. A section of the OD, which presses into the stator blade, is serrated by cold rolling between knurling dies so that it will lock the crank into the blade against radial and axial movement. These knurled serrations must be parallel to the centerline of the part so that a uniform positioning of the crank to the blade can be maintained. Any error from zero lead will cause the crank to twist as it is pressed into place or if it is restrained from twisting, the serrations will shear metal from the hole in the blade. The part is then heat treated to increase its strength and wear resistance.

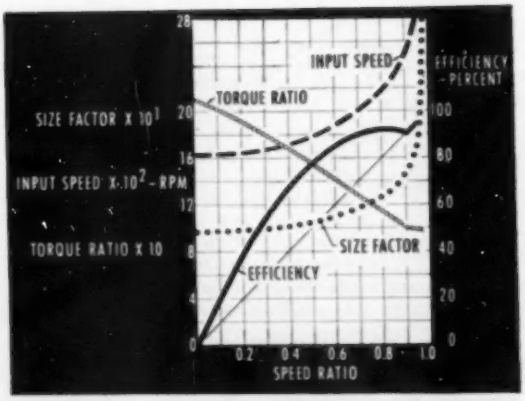
Several types of blades, including sintered powdered iron, die cast, steel stampings, and extruded aluminum were considered. They all had their shortcomings in regard to cost, durability, lack of uniformity, and performance characteristics. A smooth surface, free of irregularities, such as parting line flash, a thin trailing end, and practically no variation from part to part were required. A hot aluminum extrusion, cold drawn to maintain uniformity filled the requirements the best. The cross section of this extrusion is being maintained within 0.002 in. of the exact contour specified.

The stator blades are cut from these hot extruded-cold drawn bars. The ends are broached to form a small thrust area and to a length of 1.061 in. plus or minus 0.001 in. The crank hole is drilled and reamed, which proved to be the most difficult operation in making this part. Considering that twenty blades are used per transmission, some 63,000 parts are used per day. Requirements of this order certainly justify the utmost in tooling to provide the lowest possible unit cost.

Lincoln Turbo Drive Transmission

By H. G. English
Executive Engineer, Ford Motor Co.

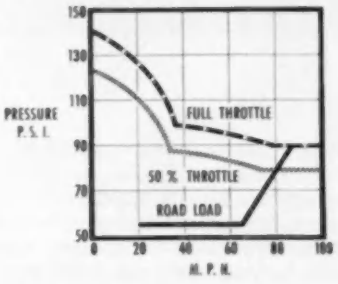
THE 1955 Lincoln Turbo Drive transmission is of the torque converter type with three-speed planetary gear box. Its 2.40/1 Low gear, plus a highly efficient torque converter with 2.1/1 stall torque ratio, provides adequate ratio coverage to permit the use of a 3.07/1 axle ratio



Torque converter performance, Lincoln Turbo Drive transmission

PART	NUMBER OF CASTINGS	WEIGHT OF ROUGH CASTING
CONVERTER HOUSING	1	12.0
TORQUE CONVERTER	4	11.6
EXTENSION HOUSING	1	6.8
HYDRAULIC CONTROLS, VALVE BODY PRESSURE REGULATOR AND GOVERNOR	7	4.2
FRONT AND REAR SERVOS	6	3.8
OTHER (CLUTCHES AND DELIVERY SLEEVE)	4	1.7
TOTAL	23	40.3

Precision aluminum castings used in Lincoln Turbo Drive transmission



Line pressure vs. car speed for various throttle settings

and still maintain excellent over-all performance.

In Drive range, starts can be made in either Low or Intermediate gears at the driver's option. Normal starts are made in Intermediate gear, however, Low gear is available at speeds below 20 mph by depressing the accelerator through the detent. Intermediate gear, 1.46/1, provides adequate start up performance for normal conditions and is also available as a highway passing gear at speeds up to 76 mph.

Cooling of the Turbo Drive transmission is accomplished by circulation of air through the converter housing. No heat exchanger is required.

The torque converter is of the single-stage type embodying three bladed members. Torque ratio at stall is 2.1, maximum efficiency is 92 per cent and clutch point is .905. Stall speed is nominally 1630 rpm.

Diameter of the converter circuit is 12-5/16 in. Both impeller shell and stator are of die cast aluminum. Impeller blades are of sheet metal and are held in place by a large snap ring at the outer ends of the blades and the sheet metal core ring. The turbine is of all sheet metal construction without brazing or welding. Vanes on the outside of the die cast impeller shell circulate air through the converter housing for cooling. No heat exchanger is required.

The gear set employed is of the double pinion planetary type employing two sun gears, six pinion and one ring gear. Gears are 15.5 DP, 17 deg 30 ft pressure angle and 22 deg 11 ft 30 in. helix angle. To provide three forward and one reverse ratio two multiple disk clutches and two brake bands are employed.

The front clutch has four pairs of plates and uses semi-metallic friction material. The rear clutch has five pairs of plates and uses sintered bronze friction material. The front band uses a woven asbestos lining with molded end segments and the rear band uses semi-metallic lining.

The hydraulic control system comprises three main assemblies; the pressure regulator, valve body and governor. The pressure regulator contains two valves, one to regulate line pressure and another to control converter charge pressure. Both line and converter pressure are varied by compensator pressure which varies with throttle and car speed. Line pressure at closed throttle is a nominal 55 psi in all ranges.

The converter housing was developed from a regular permanent mold which ultimately was utilized for production parts. To arrive at minimum weight and, therefore, minimum cost our first casting design was based on minimum sections consistent with good casting practice. The mold was subsequently reworked to increase stiffness and reduce deflection as was indicated by a series of deflection and stress studies at five load factors. After the required stiffness was obtained fatigue tests were conducted at five load factors for 200,000 cycles without failure.

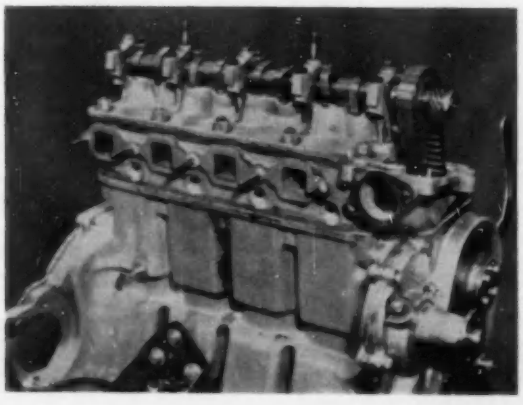
Future Aluminum Applications in the Automotive Industry

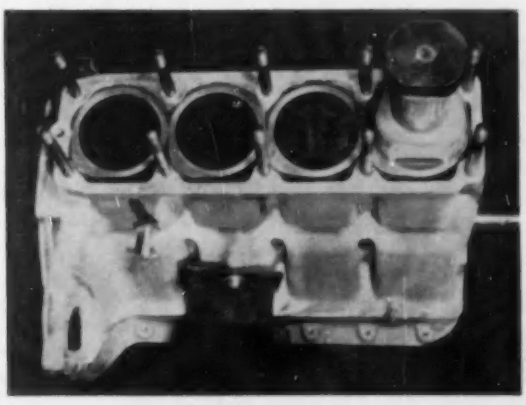
By Leo Swoboda
Kaiser Aluminum and Chemical Corp.

PRELIMINARY studies and investigations on the use of aluminum for wheels and brake drums, either as separate or integral units, show considerable promise, but more development work is needed before these will be available for general use. How-

(*Turn to page* 116, *please*)

Below is side view of partially assembled aluminum block engine, clearly showing deep external pockets characteristic of a die cast design. Illustration at right shows sand cast prototype aluminum engine block in process of having sleeves installed. Note the complete separation of all liners from each other and from top deck, thereby eliminating much distortion from both mechanical and thermal sources. The sleeves are held in place with cylinder head and gasket. Coolant flow to head is metered through holes in gasket. Photos courtesy Willys Motors, Inc.





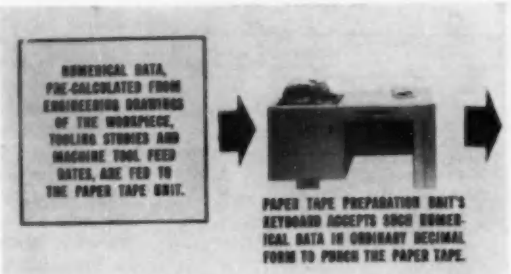
AUTOMATION NEWS REPORT

FEEDBACK

AUTOMATIC CONTROLS

PRODUCTION — VEHICLES — AIRCRAFT

By Paul Kennedy


NUMERICAL DATA, PRE-CALCULATED FROM ENGINEERING DRAWINGS OF THE WORKPIECE, TOOLING STUDIES AND MACHINE TOOL FEED RATES, ARE FED TO THE PAPER TAPE UNIT.
PAPER TAPE PREPARATION UNIT'S KEYBOARD ACCEPTS 5000 NUMERICAL DATA IN ORDINARY DECIMAL FORM TO PUNCH THE PAPER TAPE.

OPERATION OF THE G&L NUMERICORD SYSTEM OF MACHINE TOOL AUTOMATION

MORE PROFIT

Higher returns on investment may be required to compensate for the risks of obsoleting single-purpose machines built for high volume only. R. T. Collins, general sales manager of New Departure Div. of GM, observed at a recent conference that since changes in the product won't be limited, indeed are coming faster than ever, flexibility of equipment will have to be stressed more.

SIMPLER CONTROLS

The anti-repeat safety electrical circuit for large presses has been in wide use for some time. Clark Controller Co. has improved a model it offers, by replacing relays with transistors. These bits of one-way-conducting crystalline material operate at about one-fifth the voltage of the conventional relays. They allow the panel itself to be much smaller and, of course, have no moving contacts. They are "normally open" contactors, requiring energy to be supplied to operate, an additional safety feature. Troubles to date have been in production rather than in the characteristics of the transistor itself, Clark president R. H. Hoge stated at a recent conference.

COMPUTERS AHEAD

Electronic computers are more advanced than present plans for using them. Management must plan on training more men in the potentialities of the new machines, according to Dr. J. W. Forrester, director of the digital computer laboratory at Massachusetts Institute of Technology. Speaking at an AMA management conference, he explained that in 10 years the speed of handling data has increased 100,000 times, while storage capacity and reliability each are up 100 times.

NUMERICAL CONTROL BY G&L

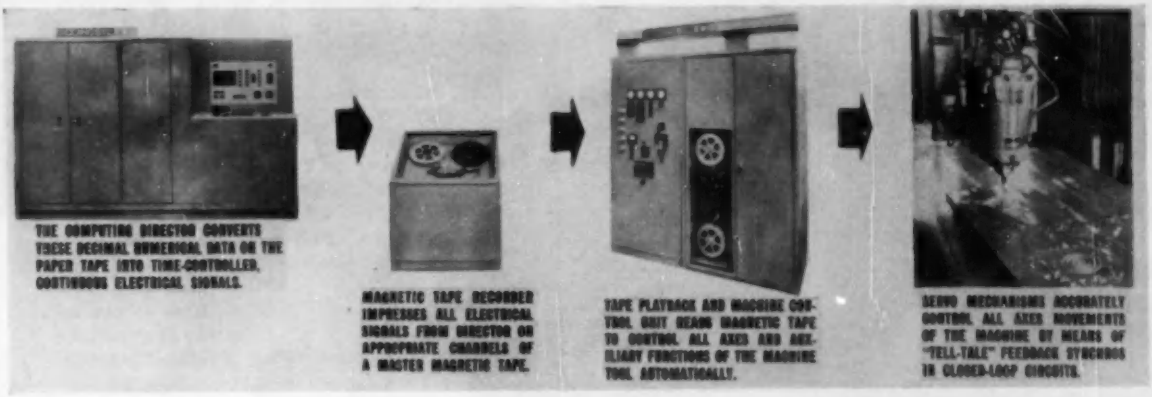
As many as five machine axes and 22 auxiliary functions can be controlled by data fed to the Numericord computer system. This tape system of programming numerical data and controlling machine tools was demonstrated last month to aircraft manufacturing and Air Force officials, and editors.

Giddings & Lewis Machine Tool Co. engineers developed the system in conjunction with General Electric Co. and Massachusetts Institute of Technology. Now commercially available for controlling skin mills, horizontal and vertical boring mills, the system is designed around commercial components. It also features fail-safe circuitry and conservative ratings on vacuum tubes. Printed circuits are used extensively.

The skin mill demonstration included all plunge, channel, pocket and contouring cuts usually required for machining wing panels from solid 75 ST aluminum plate. Tolerances were said to be limited only by the mill itself, usually ranging from ± 0.001 to ± 0.002 in. Estimates of savings for such parts as the North American F-100D horizontal stabilizer run to 50 per cent for machining time, according to G&L. Setup time is reduced, especially on setups made after the first one, since the tapes can be stored and put back into service so easily.

The machine can make its own magnetic tapes by having the operator go through the motions of cutting a sample part, or by tracing a template. Unlike some other setups, with this system, tapes can also be made by calculation. In this case, raw dimensional data is put into the first unit (illustration), a paper tape keyboard. Decimal increments of the desired machine axis feeds and speeds are punched directly, without going to a binary code. Checking circuits in the unit operate automatically to determine such command errors as exceeding feed rates or time intervals chosen, missing "plus" or "minus" signs, wrong number of digits in any command and improper least significant digit. Other supervisory circuits examine all data fed into the unit, perforating additional holes in the paper tape for logical control of the system's electronic director unit.

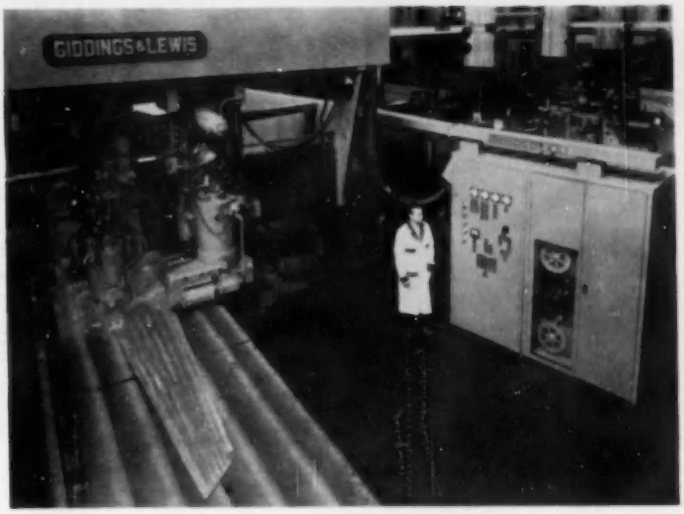
"Stop" codes placed in the paper tape sequence provide intervals for tool examination and replacement as well as for checking settings of machine verniers. Thus, tool breakage merely requires return to the first previous "stop" signal, retooling and restarting of the machine-control unit. "Stop" and other signals


THE COMPUTING DIRECTOR CONVERTS THESE DECIMAL NUMERICAL DATA ON THE PAPER TAPE INTO TIME-CONTROLLED, CONTINUOUS ELECTRICAL SIGNALS.
MAGNETIC TAPE RECORDER IMPRESSES ALL ELECTRICAL SIGNALS FROM DIRECTOR ON APPROPRIATE CHANNELS OF A MASTER MAGNETIC TAPE.
TAPE PLAYBACK AND MACHINE CONTROL UNIT READS MAGNETIC TAPE TO CONTROL ALL AXES AND AUXILIARY FUNCTIONS OF THE MACHINE TOOL AUTOMATICALLY.
SERVO MECHANISMS ACCURATELY CONTROL ALL AXES MOVEMENTS OF THE MACHINE BY MEANS OF "TELL-TALE" FEEDBACK SYNCHROS IN CLOSED-LOOP CIRCUITS.

can be made audible to the operator.

As an example of the system's flexibility, standard engineering-type computers can be used to short cut manual calculation of axes movements and time coordinates, tooling, feed, traverse and other data necessary to program complete part machining cycles.

It is the electronic computing "director" which processes decimal digital information, contained on the paper tape, into the phase-modulated continuous electrical signals for recording on magnetic tape. In operation, the director reads the punched paper tape, line for line, storing information thus serially presented in special magnetic-core memory units until later commands from the director release them to secondary memory units or directly to data-coordinating circuits for final impressing on the magnetic tape, as the program may require.



Shown on the G&L automated skin mill is an F-100D Super Sabre horizontal elevator, an integrally-ribbed skin. Operator is observing the magnetic tape playback unit and machine control unit which operate all machine axes through closed loop feedback circuits to the tape reading heads. Tape preparation equipment is in an office area.

While the director is processing one group of commands, following groups are being read into it to assure continuous motion of the machine upon playback of the finished magnetic tape.

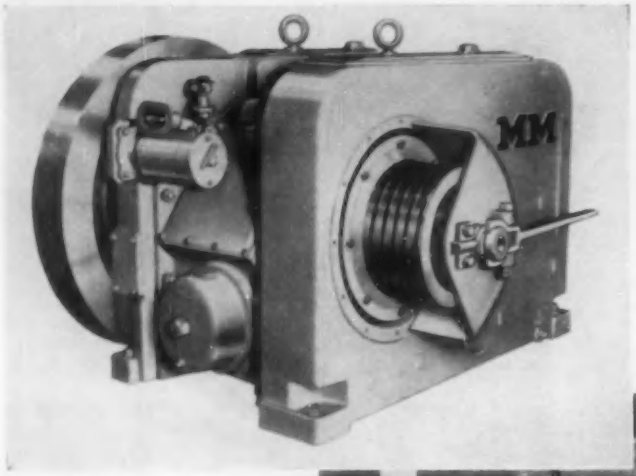
The electronic playback unit, connected to the machine tool, reads all 14 channels of the magnetic tape simultaneously, sending to the machine a constant stream of signals controlling all its movements and functions in accordance with requirements of the machining program. On the skin milling machine used in the demonstration, three Cartesian axes of the machine were under numerical tape control, plus such basic functions as "start," "stop," and traverse.

COMPANIES, MEETINGS

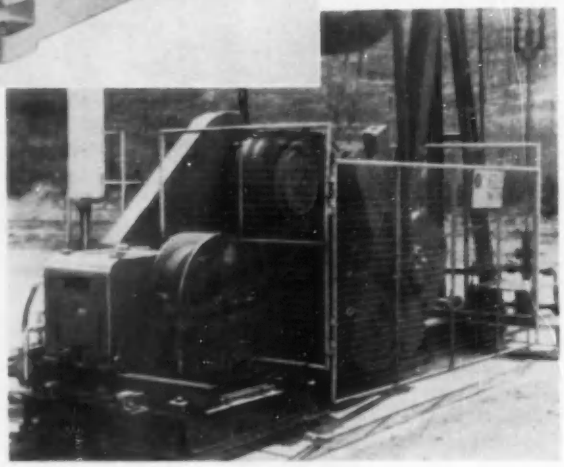
American Brake Shoe Co. recently purchased control of Denison Enginering Co., makers of hydraulic presses, pumps, and control equipment. Hall-Scott Motors Co. has entered the electronics field by purchasing Bardwell & McAlister, a firm currently doing research in the guided missile and atomic energy programs. Minneapolis - Honeywell Regulator Co. announces it has started a long-range program to develop automatic controls for machine tools, with a newly formed Machine Control Group headed by John Rudolf.

Tenth annual Instrument-Automation Conference and Exhibit at Los Angeles will include analytical clinics, Sept. 12-16. Automation will be discussed in Detroit, Sept. 28-29 at the Industrial Electronics Conference. Check with G. N. Ferrara at 8106 W. Nine Mile Rd., Oak Park 37, Mich., for details. A computer symposium will be a feature of the Second International Automation Exposition at Navy Pier, Chicago, Nov. 14-17.

(*Turn to page* 124, *please*)



Above — New MM 20-hp Timeline 168 industrial power unit.



At right—a setup with the new engine designed for long-time operation without attention.

NEW ENGINE

Designed to Run Year Without Service

A NEW engine designed to run continuously for a year without service is announced by Minneapolis-Moline Co. of Minneapolis. The 20 hp, two-cylinder engine is designated MM Timeline 168.

A totally new radial cooling system replaces the conventional radiator. Also eliminated are water pump, pulleys, fan, fan belt, and radiator hoses. Water is circulated through a cast-aluminum cooling unit built into the flywheel.

Present models use natural gas fuel. Future production for LP gas is anticipated.

The MM Timeline 168, now in production, is rated at 20 hp at 1200 rpm. Bore is 4⅜ in. and stroke is 5 in., with piston displacement of 168 cu in. Future models are planned for 15 hp, with 4¼ in. bore, 5 in. stroke, and 141 cu in. displacement; and 26 hp, with 5 5/16 in. bore, 5 in. stroke, and 222 cu in. displacement. Weight is 2150 lb.

Lubricating oil reservoir capacity is 20 gallons. The oil reservoir has a float control to maintain proper crankcase oil level. The crankcase is held at uniform temperature by water circulated through the jacket in the base pan casting. The oil filter, with a 6½ in. by 9 in. cartridge, is built into the crankcase where oil is filtered at proper temperature. Full-pressure lubrication is provided to all precision shell-type bearings, and circulates to the tapered roller main bearings.

The rotor-type oil pump is mounted on the crankshaft. No greasing is needed on this new Timeline engine.

The cooling sytem has a capacity of 12 gallons. Channels in the coolant reservoir increase circulation to maintain uniform engine temperature throughout.

The engine has a crankcase ventilating system that draws air into the crankcase through a filter breather. Vacuum draws the air and crankcase vapors through pushrod openings to the intake manifold, before those vapors can settle and contaminate lubricating oil.

A V-belt pulley flange is mounted direct to the drive ring on the power take-off end of the crankshaft. The crankshaft is supported on four large tapered roller bearings. On installation, the clutch shifter lever may be rotated to any of 12 different positions depending on direction of belt drive. The housing serves as a belt guard as well.

Removing cylinder-head nuts permits quick removal of both cylinder heads and blocks for service work, as in all models of Minneapolis-Moline engines. A large removable crankcase cover allows inspection of rod bearings and crankshaft journals.

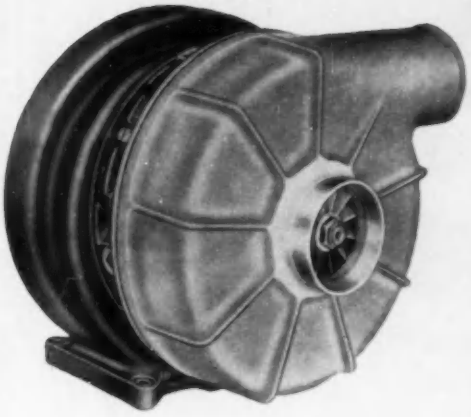
The large flywheel greatly reduces speed variations.

As a safety precaution in case of oil pressure dropping below a safe limit, or of excessive temperature of the coolant, automatic grounding of the magneto shuts off the engine.

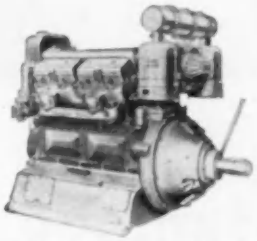
SCHWITZER -CUMMINS COMPANY *Superchargers*

POSITIVE DISPLACEMENT AND TURBO SUPERCHARGERS FOR INTERNAL-COMBUSTION ENGINES

EXHAUST DRIVEN TURBOCHARGERS for engines 40 to 400 brake horsepower, naturally aspirated.



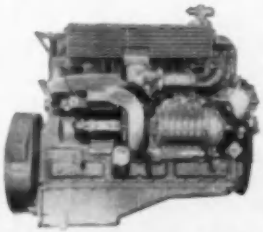
POSITIVE DISPLACEMENT SUPERCHARGERS for engine sizes from 50 to 500 HP, and pressure ratios of 2:1 max.



Model D-375—Caterpillar Diesel V8

For over a quarter of a century SCHWITZER-CUMMINS SUPERCHARGERS have received widespread recognition throughout the industry for their reliability, economy and unexcelled performance.

Superior engineering and skillful workmanship, backed by a multi-million dollar investment in up-to-date facilities, teamed up to develop this excellent product so that it is today first choice of leading internal combustion engine manufacturers.



Model HRBS-600
Cummins Engine Company, Inc.
(Used also on HBS Series)

SOME FAMOUS ENGINES SUPERCHARGED BY **SCHWITZER-CUMMINS**
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INTERNATIONAL · HERCULES ·
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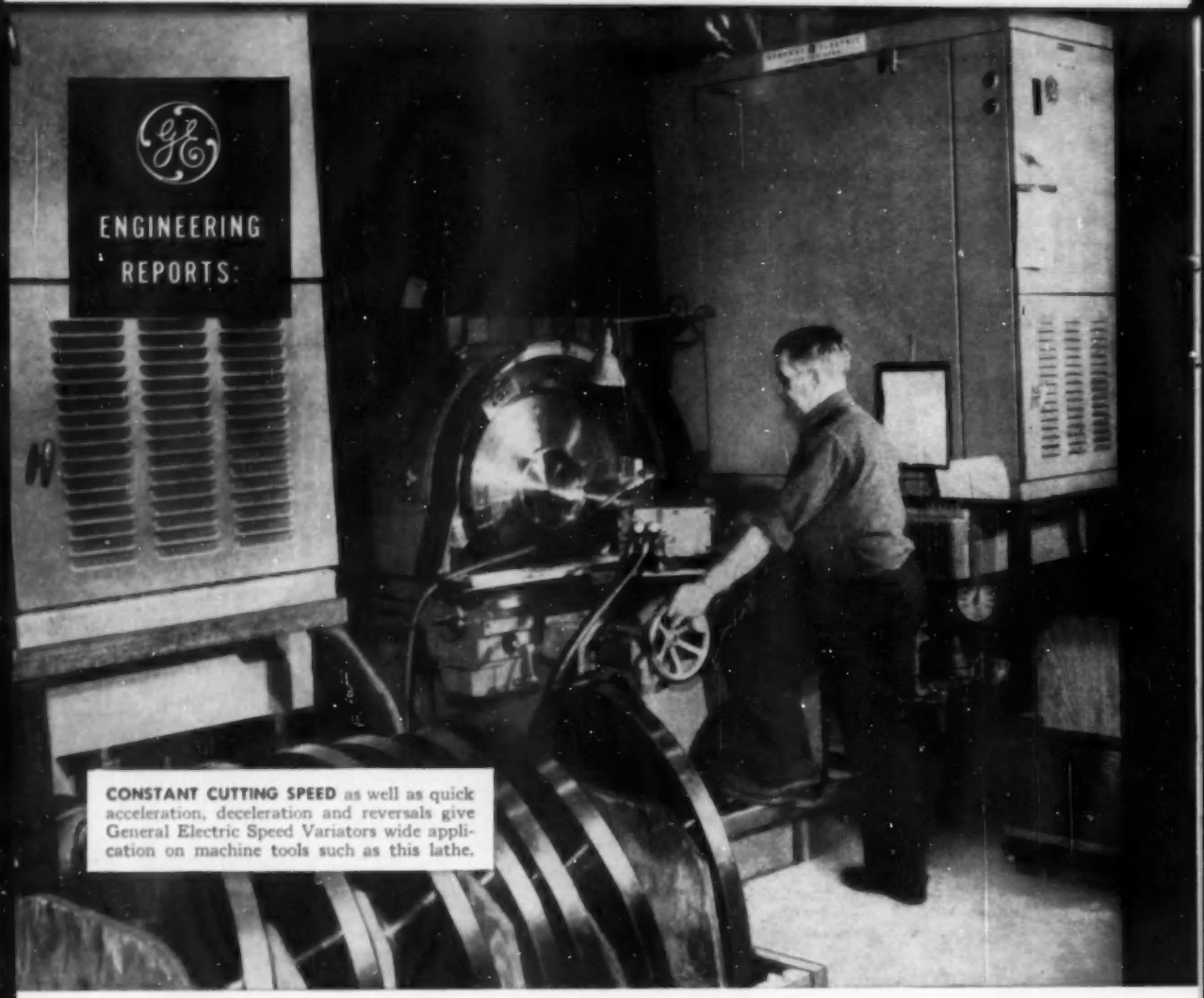


CONSTANT CUTTING SPEED as well as quick acceleration, deceleration and reversals give General Electric Speed Variators wide application on machine tools such as this lathe.

G-E SYSTEM-ENGINEERED . . .

J.I.C. Speed Variator gives stepless

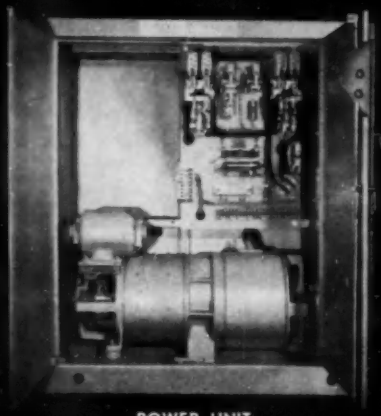
Designed specifically for the automotive industry, G.E.'s J.I.C. Speed Variator is system-engineered to meet Joint Industry Conference electrical standards. It provides highly efficient operation over wide speed ranges from 8-to-1, up to 50-to-1, without intermediate speed-changing equipment. Each unit is a complete adjustable-speed system—factory-assembled and tested, ready to install and operate. You get a packaged all-electric drive operating from a-c power.

Components include a d-c motor, operator's control station, and a power unit cabinet which houses a motor-generator set and all necessary control.

Standard optional features include dynamic braking; reversing and dynamic braking; reversing, jogging and dynamic braking; electronic regulators; various d-c drive motors such as dripproof, splashproof, totally enclosed fan-cooled, and totally enclosed unit-cooled. Practically any speed range desired can be obtained, and, in addition to standard units, G-E engineers will tailor units to your particular application.

G-E Speed Variators are widely applicable in the automotive industry on machine tools such as lathes, grinders, milling machines, broaches, slotters, boring mills, as well as on testing stands and conveyor systems. Bulletins GEA-6000 and GEA-6127.

GENERAL ELECTRIC



POWER UNIT

D-C MOTOR

OPERATOR'S PANEL

J.I.C. PROTECTION FEATURES

POWER UNIT

- **Rigid, all steel enclosure**
- **Positive pressure ventilating system: Air pressure inside power unit higher than outside—helps keep dirt and dust from equipment.**
- **For added personnel safety, gasketed doors are mechanically interlocked with fusible disconnect switch. Switch locks in OFF and ON position. No door can open with power on.**
- **Color-coded wiring**
- **A-c control in separate compartment—easily accessible.**

DC DRIVE MOTOR

- **Rugged, totally-enclosed—provides better protection against oil, moisture, dust and dirt.**

OPERATOR'S PANEL

- **Push-buttons, rheostats and instruments in NEMA 12 enclosure.**

POWER UNIT of G.E.'s Speed Variator has space for additional control. System components are factory-packaged and tested to cut installation time and cost.

"PACKAGED" POWER UNIT contains all conversion and control equipment. Installs in any reasonably level floor space—no foundation needed.

ADDED SAFETY of interlocked, gasketed doors, and lockable disconnect switch helps protect personnel. Doors cannot be opened with power on.

adjustable speed, precise control

USE THIS COUPON FOR MORE INFORMATION...

GENERAL ELECTRIC CO. SECTION 8815-3
DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT, ERIE, PA.

Please send the following bulletins:

√ For reference only X For an immediate project

☐ GEA-6127, 1-200 hp Speed Variators ☐ GEA-6000, 15-30 hp JIC Speed Variator

NAME .....

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1st In a Series . . .

OF HIGH PRODUCTION CASE HISTORIES

ASK BAIRD ABOUT IT

Before and after views of the machining operations performed on the Baird 76H Automatic Chucking Machine.

8 OPERATIONS ON HEAD CASE

OF COLD DRAWN MILD STEEL

Production . . .

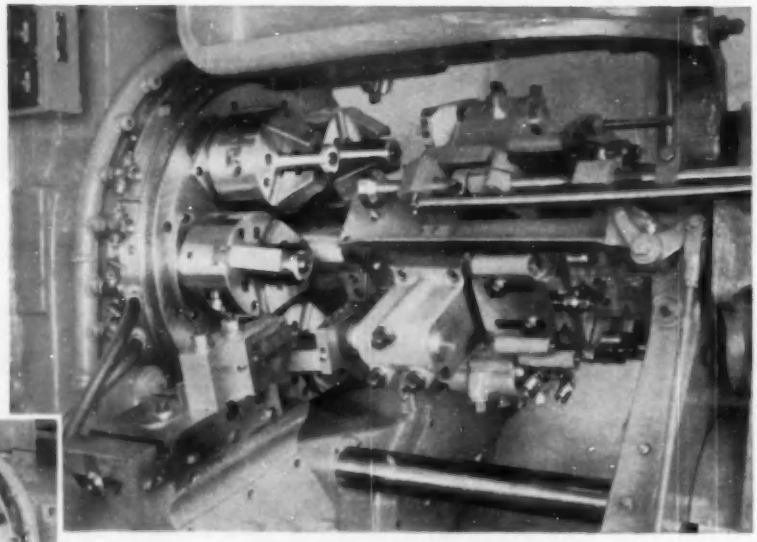
198 PIECES PER HOUR

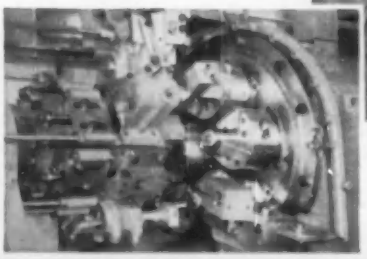
The machine tooled for production of these parts at extremely low cost is the Baird 76H Automatic Chucking Machine.

Operations are: rough and finish turn the smaller O.D. . . . face the shoulder . . . rough and finish larger O.D. for threading . . . face the end, cut recess for threading die and chamfer the ends. Prevention of tool marks on the finished surfaces is assured by indexing the work away from the tools at the conclusion of the cutting.

Even though you may not have Head Cases to finish, there are many similar jobs that can be produced at most favorable competitive costs on the Baird Chucker with high speed tooling set-ups.

"Ask Baird about it." Write Dept. AI.





(Above) **Front view of tooling showing 4 of the 6 chucks.** *(Left)* **Rear view of the tooling.**

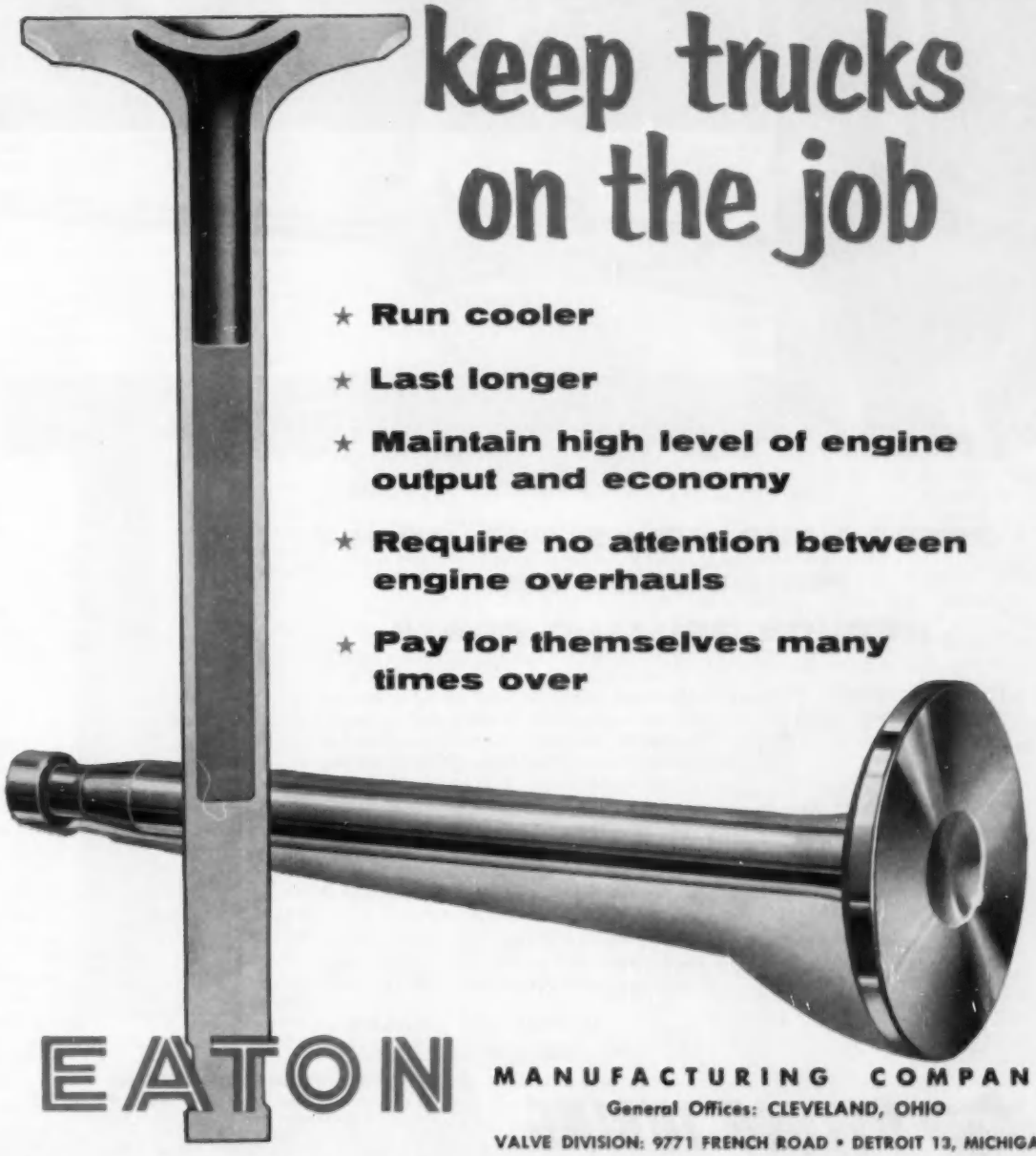
THE BAIRD MACHINE COMPANY

STRATFORD CONNECTICUT

WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

Eaton SODIUM COOLED VALVES keep trucks on the job



- ★ **Run cooler**
- ★ **Last longer**
- ★ **Maintain high level of engine output and economy**
- ★ **Require no attention between engine overhauls**
- ★ **Pay for themselves many times over**

EATON MANUFACTURING COMPANY

General Offices: CLEVELAND, OHIO

VALVE DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN

PRODUCTS: Sodium Cooled, Poppet, and Free Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

Kennametal tools working in a coal mine.

OSTUCO TUBING HELPED BOOST PRODUCTION AND REDUCE DRILLING COSTS

The Problem: Various mining augers originally used with Kennametal Tungsten carbide bits were frequently replaced due to bending and twisting—particularly in hard, fast drilling. This resulted in excessive downtime, and limited potential drilling life of the Kennametal bits . . . which are capable of drilling from 4,500 to 12,000 feet.

The Solution: New Kennametal augers, manufactured from OSTUCO Seamless Steel Tubing, last the life of several bits. These tubular augers have rigidity to stand the high pressure of fast, long-hole drilling, yet are light weight for easier handling underground. Lightness, rigidity and long wear are especially important in drilling holes of 100 feet depths during mining of anthracite coal and gypsum.

Discuss your particular problems with an OSTUCO Tubing Engineer. Then take advantage of OSTUCO's convenient *Single-Source* Service and fill all your tubing needs on one order. Write or call your nearest OSTUCO Sales Office, or write OSTUCO, Shelby, Ohio.

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SEAMLESS AND ELECTRIC WELDED STEEL TUBING
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News of the MACHINERY INDUSTRIES

By Thomas Mac New

Gearing Problems Discussed and Officers Elected at 39th Annual Meeting of the AGMA. Machine Tool Orders Up Materially Over Last Year

AGMA Still Growing

Over 350 persons registered for the 39th Annual Meeting of the American Gear Manufacturers Association at Hot Springs, Va., last month. This was by far the largest group ever in attendance at one of business and engineering conferences held by the organization.

Highlights of the three-day meeting were the election of officers, three technical papers, and the large number of committee meetings. New officers this year are headed by Marvin R. Anderson, executive vice president of Michigan Tool Co., who is the 1955-56 President of the Association. The Vice President is Fred R. Eberhardt, president of Eberhardt-Denver Co.; and the Treasurer is Gunnar E. Gunderson, president of Brad Foote Gear Works, Inc. Elected to the Executive Committee were: John L. Buehler, president of Indiana Gear Works; R. W. Johnson, director of sales of Foote Bros. Gear & Machine Corp.; Walter W. Trout, president of Lufkin Foundry & Machinery Co.; and D. W. Diefendorf, president of Diefendorf Gear Corp.

In a paper on Spiroid gears presented by Fred Bohle and Oliver Saari, Illinois Tool Works, it was stated that Spiroid gears seem to be ideally suited for all those drives where high accuracy of rotation is the goal. For one thing, the average rotational accuracy of many threads or teeth in simultaneous contact is superior to those gear drives where contact varies between one and two teeth. Furthermore, the authors stated, one of the great obstacles along the road towards high indexing accuracy is the control of runout. Spiroid gears, like all other gears, are located by their holes or shafts. However, as a rule they are clamped and held by their back faces during hobbing. This, usually, is a relatively large and easily controlled surface on the gear as well as on the hobbing machine. Whatever radial runout is present after hobbing and mounting has less effect on rotational accuracy and play because the gear operates on the side of the pinion. The same holds

Marvin R. Anderson executive vice president of Michigan Tool Co. has been elected President of the American Gear Manufacturers Association.

true of the effect of differential thermal expansion, as the temperature of gear and housing varies in service.

Gearing Gobbledygook, a paper presented by Louis D. Martin, gear consultant, pointed out the many errors and the confusion in drawings of gears released for production. He showed many examples of prints that have come to his attention recently.

Walter P. Schmitter, vice president and chief engineer of the Falk Corp., spoke on the AGMA surface durability rating standards for spur, helical and herringbone gearing. The paper was a recapitulation of the development of the AGMA standard ratings.

Machine Tool Orders Surpass $238 Million

Although the machine tool industry is not receiving the volume of orders it anticipated at the beginning of the year, business in the past few months was up materially over last year.

Orders in April fell by $10 million from the previous month but, nonetheless, brought total business for the first four months to more than $238 million compared with $190 million in the like 1954 period. While orders from the Government have been slow in coming, as this is written it is expected that by the end of this month (June) the Air Force will place a minimum $10 million order for machine tools with industry. Altogether, the Air Force has appropriated $84 million for machine tools within the next year.

Biggest Expansion In History Underway At Snyder Tool

Snyder Tool & Engineering Co., Detroit, is celebrating its 30th anniversary this year with the largest expansion program in its history. The $500,000 expansion will give the company its most modern plant for making automation equipment and special machine tools.

Scheduled for completion by early fall, the new 20,000 sq ft factory, to adjoin the company's main plant in Detroit, will increase manufacturing space by 50 per cent. Designed to meet the trend toward longer and more complex automated equipment, the new facility will provide for building machines up to 250 ft long and 25 ft high.

The new plant will provide more than 250 hp for testing new machines. Twenty-five-ton cranes will be used to haul machines to a covered throughway, from which they will be shipped.

Around the Industry

Bullard Co., Bridgeport, Conn., has released a new motion picture entitled "Yankee Toolmaker." The film commemorates the firm's 75th Anniversary.

Ajax Electric Co., Inc. Philadelphia, has recently installed at the Saco Lowell Shops, Me., what is believed to be the world's longest line of batch-type electric salt bath furnaces. The equipment is for large volume neutral hardening, martempering, and tempering operations.

(*Turn to page* 126, *please*)

NEW EQUIPMENT PLANT • PRODUCTION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Four Sections on Transmission Case Machine

A 150-FT long transfer machine, which is made in four individual sections, performs 182 milling, drilling, tapping and boring operations on a cast iron automotive automatic transmission case. It cycles to produce 100 cases per hour at 80 per cent efficiency.

Each section can be individually controlled, loaded and unloaded. Oply mounted, yet travel at correct surface speeds. Compound milling slides, in which the cutters feed to depth and then cross feed, are also featured.

Transmission cases which have a milled mounting face and two reamed dowel pin holes are manually loaded on a fixture in the transfer mechanism. The parts are then delivered to the first section which has 19 stations and 10 spindles. Here both ends are face milled, a counterbore is turnfaced, three diameters are rough and semi-finish bored and faced with duplex cutters, two pads are side milled, a pump pad is face-milled and a clearance slot is milled.

Sectionalized transfer machine includes control panels, tool control boards and provision for loading and unloading at each section to build stock while other sections are idle.

eration of all sections can be controlled by one operator if desired. Individual transfer mechanisms are provided for each machine section. When one operator controls all sections, the transfer bar controls the operation of each section.

The hydraulically-powered, electrically controlled machine has single control panels for each section. Special devices orient the parts to three different positions.

Duplex boring spindles, in which individual inserted tooth carbide milling cutters are mounted on separate concentric spindles, are featured in two stations on the machine. This type of spindle design enables cutters of different diameters to be compact-

The part is tipped up 90 deg at one of the stations, orienting the part with the extension case end up, at which position it remains through the first and second sections.

The second section has 31 stations and 91 spindles. Here 51 holes are drilled, countersunk, semi-finish and finish-reamed, spotfaced and tapped. These holes are in the top face, one end and at angular locations inside the case. At the end of the second section, the part is tipped down 90 deg and rotated, thus positioning the case with the shaft centerline parallel to the transfer bar.

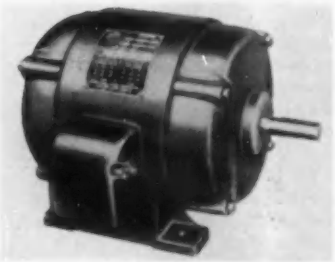
The third section has 17 stations and 21 spindles. At one station in this section, the part is removed from the transfer bar line to a fixture where the part is tipped 45 deg to drill and ream an angular inside hole.

At the end of the third section, the part is turned 90 deg and tipped up 90 deg, thus reorienting the part with the pump face end up. Then it is transferred into the fourth section, with 24 stations and 60 spindles. Here drilling, chamfering, tapping, semi-finish and finish boring, and facing operations are performed. Duplex boring spindles are also utilized in this section. *Snyder Tool & Engineering Co.*

Circle 16 on postcard for more data

Motors Announced

INDUSTRIAL electric motors built to the new NEMA standards incorporate desirable features to be found in motors today. Features of these a-c motors include better protection. A lower air opening in the end-bell combined with a steel baffle plate gives maximum protection to the winding from moisture and abrasive dusts in the drip-proof design. Double-end ventilation is provided by dual cast alu-



New Lima a-c motor

minum fans. Through newly developed insulating materials, improved electrical designs, increased cooling capacity and the use of double-width prelubricated sealed ball bearings, a definite contribution is made to increased service-free life.

Currently, all standard ratings are available in the new smaller frame sizes 182, 184, 213 and 215. The balance of the line, up to and including 30 hp, is being processed on an accelerated schedule. *Lima Electric Motor Co.*

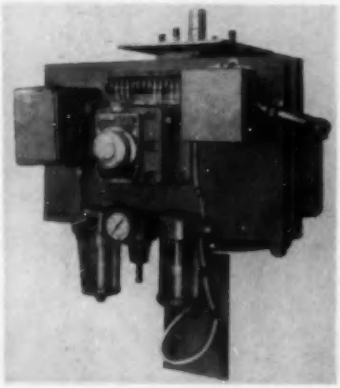
Circle 47 on postcard for more data

Heating Control

A NEW lift-rotate and scanning spindle is a work-handling machine for automatically moving parts, gears and shafts through induction heating coils and quenching them, following a preset cycle. The maximum work load of the device is 50 lb with ¼ cu ft of free air per cycle. Scanning speed range is ¼ to 2 in. per second, with an accuracy of ±2 per cent for a given setting and temperature.

The spindle can be loaded in the top position above the quench and coil permitting rapid loading and unloading when using a spray quench. It is also applicable to parts requiring submerged quench. This apparatus is an integral assembly including all valves, piping, terminal board for wiring and sink-mounting plate with gaskets. *Westinghouse Electric Corp.*

Circle 48 on postcard for more data

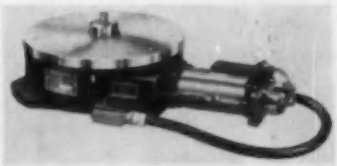


Lift-Rotate spindle for induction heating furnaces.

Close-Tolerance Index Table

A 13-IN. diam rotary index table, model BRET-13, is designed for use where high accuracy in automatic feeding of work to tools is required. It can maintain repeat accuracies as close as 0.0005 in., the company states. A unique cam movement assures a positively locked table top at all times. The table top is equipped with hardened and ground steel dowel pins which are engaged by hardened tool steel pawls to index the top and lock it in exact work position. The table top rotates on hand-scraped surfaces of the base housing.

The unit is available in three styles: one for fixed indexing of four stations; one adjustable for indexing either six or 12 stations; and one adjustable for six, nine, or 18 stations. Other numbers of stations can be furnished on order. *The Bellows Co.*



Bellows rotary index table.

Circle 50 on postcard for more data

Low Cost Shielded Arc Process

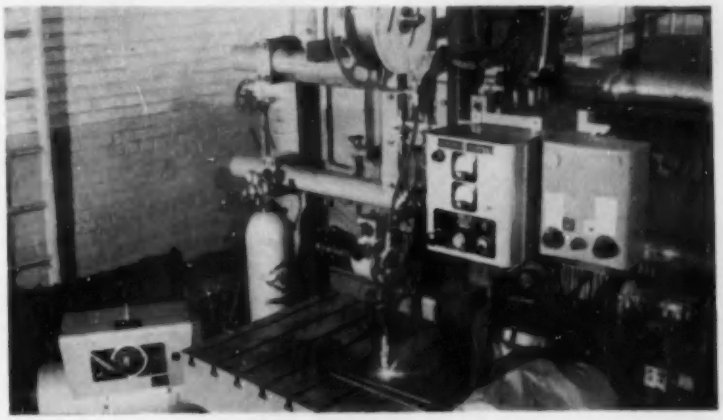
AUTOMATIC, consumable - electrode welding equipment has been especially adapted for use with low-cost carbon dioxide shielding gas. The advantages of the gas-shielded techniques reportedly are economical for mild-steel fabricating. In addition, superior results with argon or helium gases have been demonstrated with the equipment on aluminum, copper, stainless steel, and other alloys.

The self-regulating Fillerarc generator was developed originally for semiautomatic welding. It has a rising volt-ampere characteristic matching the rising volt-ampere characteristic of the arc with inert-gas or CO_2. The rate at which the electrode burns off always matches wire-feed speed, and the arc length remains constant. The operator selects the arc length on a dial, together with wire speed feed, and current and voltage adjust automatically.

With former methods, wire-feed speed had to be changed in automatic welding to equal the burn-off rate of the electrode. This required complex electro - mechanical control systems that are often difficult to maintain.

The complete equipment includes wire-feeder, torch, control panel, reel mount and motor-generator unit. It employs extremely high wire speeds (up to 1000 ipm) and very short arc lengths to produce a deeply-penetrating arc with a minimum of spatter. The technique also causes violent agitation in the weld puddle, allowing more porosity-producing gas to escape. Two recent advances led to development of a practical method of using CO_2: an understanding of the need for a shorter arc and higher wire-feed speed in gas-shielded welding, and the recent availability of dry, welding-grade CO_2 which is required for welding with this process. *General Electric Co.*

Circle 49 on postcard for more data

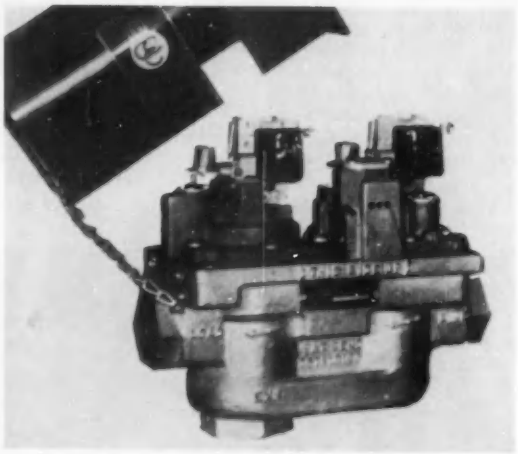


Fillerarc equipment for carbon dioxide visible-arc welding will allow substantial savings through the use of simple fixtures, and up to 50 per cent faster operation on certain applications through reduction of set-up time, according to G.E. engineers.

NEW EQUIPMENT PLANT · PRODUCTION

Air Valve is Inherently Safe

LARGE presses with air-operated clutches and brakes can be made more nearly fail-safe with the type PV double valve now being demonstrated. The main valve operates as usual, while the safety valve only operates as needed. This nearly rules out a simultaneous failure of both valves. Each is spring loaded.



Clark type PV protector valve, for 250 to 2500-ton presses with air-operated clutches or brakes, or a combination of the two, has stand-by safety unit which operates to stop the press only when operating unit fails to function.

Both magnetic pilots operate with every stroke of the press. The safety or permissive pilot intercepts the feedback signal which would otherwise cause the safety valve to shut off air. It also checks on proper operation of the operating valve and pilot, as well as on itself. In addition, a safety verifier piston will operate the safety valve if air pressure in several places in the system is unbalanced. These self-checking features cover such faults as ruptured diaphragms, burned out or faulty magnet coils, jammed operating lever on either pilot, bent stem on operating valve or either pilot, or failure of valve to close fully. When the safety unit operates, the fault which caused the action must be cleared.

Valves are 1¼ in. poppet type, with Teflon or rubber O-ring type seats. They are diaphragm operated, and controlled by moving armature magnets rather than solenoids. All parts can be removed from the valve body without disturbing plumbing. *Clark Controller Co.*

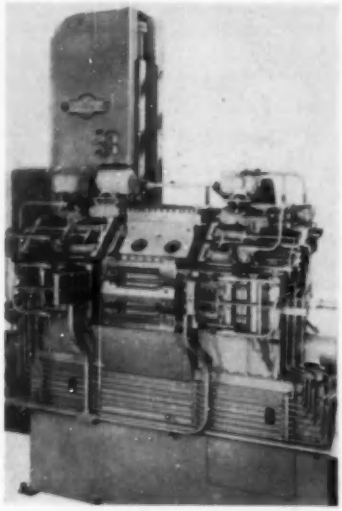
Circle 51 on postcard for more data

Broaching and Centering Machine for Axle

THIS machine broaches the end of an automotive rear axle to length and then centers the broached surface. The machine is arranged with four two-station fixtures equally spaced on an indexing trunnion which operates on an eight index arrangement.

Two parts are unloaded and loaded by the operator at the front of the machine as the parts rotate past. In simultaneous operation, two parts are surface broached at the back station while two parts are center-drilled at the top station. The operator pushes buttons after loading, to start cycle. The parts automatically clamp and index 45 deg to an intermediate index station. This allows parts broached to swing clear at the back broaching station so the broach can be returned up to starting position. Parts previously drilled at the top station also unclamp as they rotate down to an intermediate station. When the broach has returned to starting position, the trunnion indexes another 45 deg to present two parts for broaching, two for drilling and two for unloading. The operator then reloads and pushes buttons to repeat cycle. *American Broach & Machine Co.*

Circle 52 on postcard for more data



American broach with Geneva index.

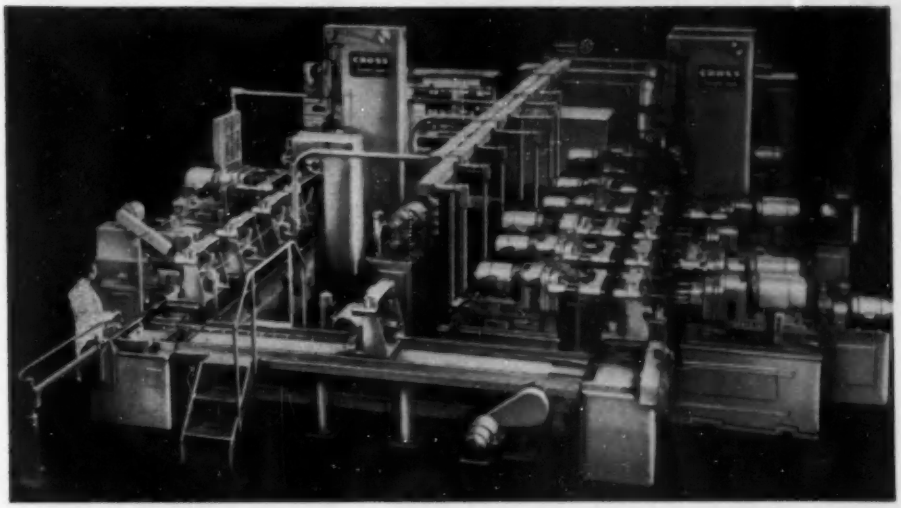
Speed Reducers

DOUBLE-ENVELOPING worm gear speed reducers are now available as motorized units. The line includes both standard extended shaft and the recently introduced shaft mounted models with worm over, under or vertical. They can be ordered with or without motors since the motor bell-housing adapter will accommodate standard NEMA C-type flanged motors. Pulleys, sheaves, belts, bearings, torque arms or motor bed plates are not required. The complete unit is simply coupled to the shaft to be driven, or on the shaft if a shaft mounted model is specified.

Motorized shaft mounted reducers are rugged enough to permit hanging unsupported loads on the reducer in many applications, according to the maker. Large taper roller bearings on the output shaft and a heavy, ribbed housing that can be foot mounted are responsible for this feature. All models can be wall-, ceiling- or floor-mounted in any position desired. *Cone-Drive Gears, Div. of Michigan Tool Co.*

Circle 53 on postcard for more data

Finishes Either of Two Flywheel Housings



This special machine is designed to completely machine flywheel housings for both standard and automatic transmissions, except for grinding three faces. Either part may be produced as required by automatically scheduling setup changes and the proper tools at each station. There are 139 operations performed on 170 pieces per hour at 100 per cent efficiency. Parts remain on palletized work holding fixtures. (Cross Co.)

Circle 54 on postcard for more data

Small Controller

THE Fultrol thermostatic pilot controller, measuring only 3 13/16 in. in width, provides accurate temperature control of liquids or air when used in conjunction with valves, dampers, and other controls. It is installed at the location where temperature is to be maintained. The rod-and-tube thermal element of the instrument is immersed directly in the medium being controlled. The new controller may be installed in any position—vertically, horizontally, or diagonally.

Any change in temperature at the thermal element activates a small modulating pilot valve, which in turn varies the control pressure applied to a motor valve or any other final control device. The operation of the final control device governs the amount of either cooling or heating applied to the medium under control.

The instrument is well suited for use with compressed air, water or any clear, low-viscosity hydraulic medium. It is designed to control temperatures in wide adjustable ranges from 50 to 250 F, and from 150 to 350 F. Other ranges are also proposed. *Fulton Sylphon Div., Robertshaw - Fulton Controls Co.*

Circle 55 on postcard for more data

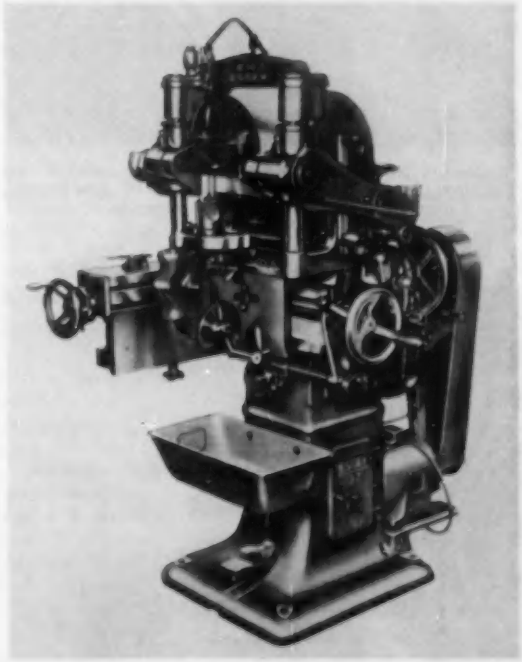
Pressure Switch

A PISTON-OPERATED hydraulic pressure switch just announced may be used on hydraulic machine tool applications where surges of considerable magnitude are present. A new strain relief mechanism has been incorporated in the switch which allows the range spring to absorb the impact of a violent pressure surge. A Quad ring seal around the piston is said to prevent oil leakage and eliminate the necessity for an oil return line. Types without the Quad ring are available for closer differentials, if desired.

The switch has snap action contacts —one normally open and one normally closed in a self contained, arc-resistant melamine case rated for ac or dc control circuits. They may be obtained with a range of 135 to 1000 psi or 400 to 3000 psi. *Square D Co.*

Circle 56 on postcard for more data

One Setup Makes Blanking Punch



Latest version of a shaper to produce blanking punches features swivelling table for dividing head. Operator can put relief on punches or draft on hobs. The Essex 32A punch shaper makes the punch a few thousandths oversize, then the punch is sheared into the die slightly. Rest of punch is finished with microscope to 0.0005 in. (British Industries Corp.)

Circle 57 on postcard for more data

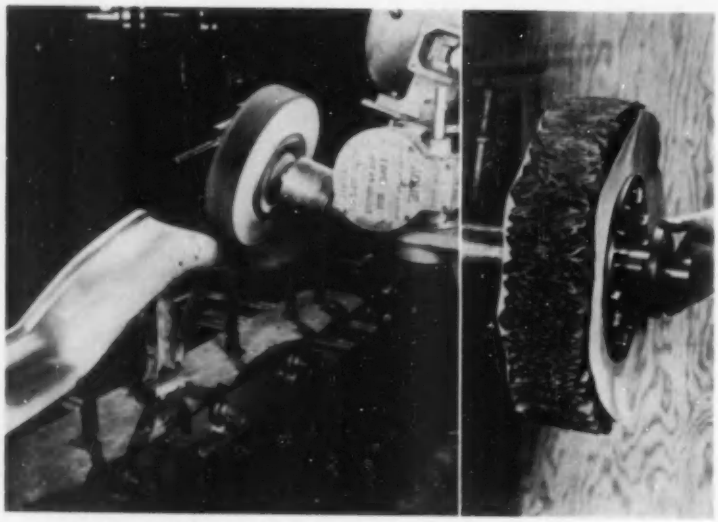
NEW EQUIPMENT — PLANT • PRODUCTION

Polishing Wheel Holds Contour

A WEARABLE coated abrasive wheel has been field tested for straight-line or rotary polishing equipment. Long life and maintaining an easily-made contour are claimed as features.

The wheel consists of U-shaped packets of folded abrasive sheet, held in a demountable hub. Wheels are 17 in. in diameter, two to seven in. wide, made of silicon carbide or aluminum oxide cloth in 120 to 400 grit. Low pressure and 1500 to 2400 rpm speed provide cool, distortion-free work. *Behr-Manning Div., Norton Co.*

Circle 58 on postcard for more data



One Kon-Toor polishing wheel seven in. wide is reported to have increased production 15 per cent and cut abrasive costs 50 per cent. Here floating head polishes angular and curved bumper surfaces. At right, converting to new head with proper bushing.

Speed indicator may have an electro-mechanical counter added.

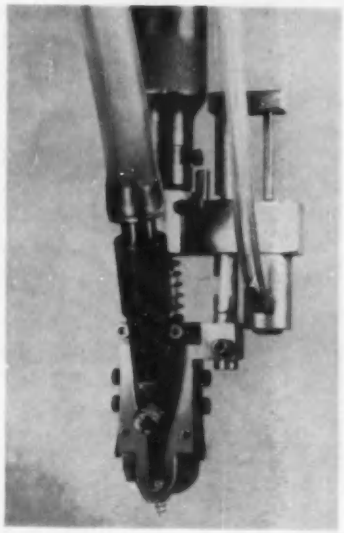
Speed Indicator

ACCURACY of 0.5 per cent is claimed for model 426 speed indicator. A Weston model 750 low ripple d-c tachometer is driven by a Gilmer timing belt. Speed is shown on a Weston model 901 meter with a calibrating potentiometer, on two ranges, 0-60 and 0-120 mph. Bendix Eclipse type K hub with 36 spokes and heavy duty rim, U. S. Royal Master tire selected for balance and runout are furnished. Steel tube frame has Oilite-bushed damped pivots. *Performance Measurements Co.*

Circle 59 on postcard for more data

Screw Feeder

DETAILS of an automatic screw feeder for standard power screwdrivers have been released. The device feeds screws up to ¼ in. in diameter and up to 1¼ in. long, in virtually any head style. The hopper may be up to 20 ft from the driver and head assembly. The head assembly is claimed to operate at any angle in any plane, on a hand-held or automatic driver. *Pneuma-Serve, Inc.*



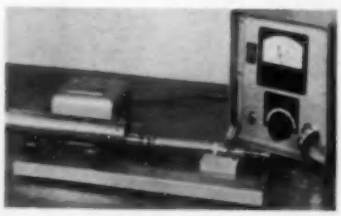
Close-up of Pneuma-Serve automatic screw feeder mechanism for power screwdriver.

Circle 60 on postcard for more data

For Round Surfaces

TYPE RF Cylinder Piloter is announced for taking profilometer roughness measurements around the circumference of tubing, round bar stock, and other cylindrical pieces.

The piece to be measured is placed on two pairs of rollers, as illustrated. One roller is driven by belt from a constant-speed motor in the housing, and rotates the work at a surface speed of 0.3 in. per second, roughness



MMC profilometer

measurement is made by a type LA Tracer. The equipment illustrated provides for measuring around ID's as small as ¾ in. and around OD's from ¾ to 3½ in., and provides a 7¼ in. lengthwise adjustment of the Tracer position. Minimum length of work accommodated is 2½ in., and maximum recommended length is 12 in. Other Profilometer Pilotors of similar design can be furnished for larger or smaller OD's and for shorter or longer work. *Micrometrical Mfg. Co.*

Circle 61 on postcard for more data

One-Mast Lift

THE unique Monomast lift truck features a single mast of two box-type sections, one telescoping within the other. Total weight of the upright is about the same as standard type

Panoramic visibility is claimed for the Monomast lift truck.

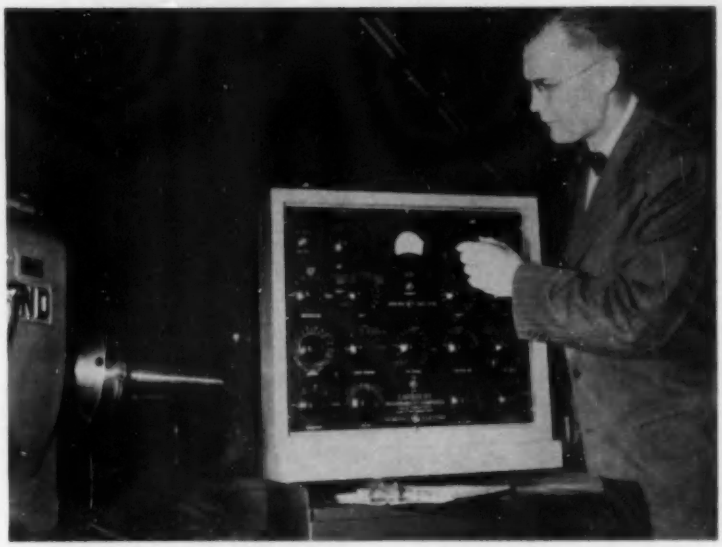
assemblies. Torsional rigidity in the mast has been increased 80 per cent and mast deflection reduced 50 per cent over conventional upright or mast assemblies, it is claimed by the manufacturer.

The design allows a 15 per cent increase in hoist speed. Load raising speed is now 58 fpm with a corresponding increase in load lowering speed. Slight horizontal carriage flotation is a desirable feature which permits the lift truck to angle back out of tight positions after load depositing. The mast has been designed for the maker's UC-30 and YC-40 models and can be field installed on current models. *The Hyster Co.*

Circle 62 on postcard for more data

Analog for Computing Machinability

AN electronic computer revealed recently will enable a methods and service man to determine quickly whether or not he is using a correct set of conditions for machining a current job; help him arrive at a proper set of conditions for setting up a new machining operation, or indicate to him the relative advantages of changing some of the present job conditions to obtain greater production. The computer will consider 14 operational variables in machining, such as grade of carbide, speed, feed, depth of cut, tool life, alloy, material hardness, etc. It can be fed information on any of 13 variables and come up with the 14th. It also will consider five variables which affect the motor horsepower required to do a machining job, coming up with the answer after being fed with information on four of the variables.



G.E. machinability computer will solve machining problems in minutes which take hours by other means.

Answers provided by the computer are based on the use of those feeds, depths of cut, proper grades of carbide and tool geometry which will result in a normal wear type cutting edge failure. Each computer will be registered and Carboloy will periodically update users with the latest machinability data. *Carboloy Dept., General Electric Co.*

Circle 63 on postcard for more data

Counterbalancing Hoist

An air - operated hoist which will counterbalance two different loads is being offered in six weight ranges. The heaviest will automatically counterbalance a tare load of 15 to 80 lb. and a total load of 50 to 325 lb. A power-steering-gear type of air valve allows the load to be raised or lowered with a light hand pressure on the load itself. (The Platz Co.)

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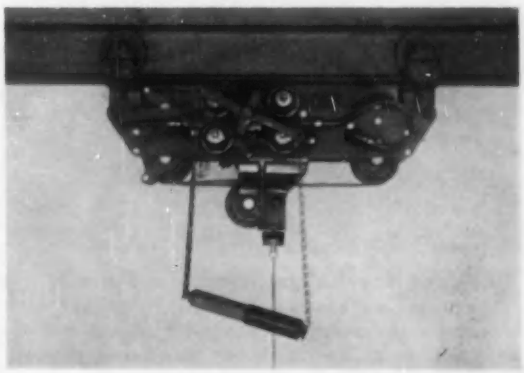
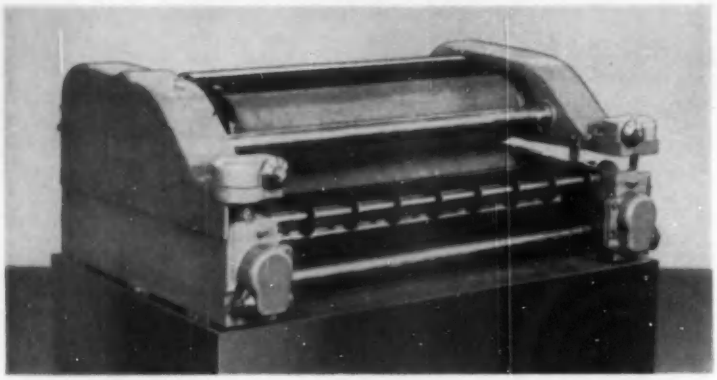


NEW EQUIPMENT PLANT · PRODUCTION

Machine Coats Sheet Metal



The Roller Coater Unit for use on sheet metal is designed to coat both sides of the sheet. Adjustments to the correct coating thickness are easily made with vernier controls, with visual gages. Mechanical drives permit removal of the rolls for cleaning without removing, restringing, or resetting the drives. Upper and lower roll assemblies are independent. (Murray-Way Corp.)

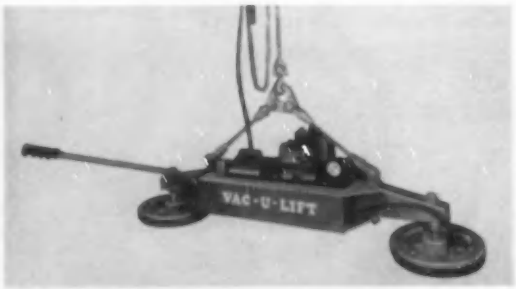
Circle 65 on postcard for more data

Lifts By Vacuum

A VACUUM lifting device now on the market will lift any object with a non-porous surface that is large enough to allow the vacuum pads to attach themselves. Vac-U-Lift Units reportedly can handle weights up to several tons with an ample safety factor. The unit is said to operate on steel plates, large castings, pipes, drums, paper cartons and such things as diamond tread steel plates and truck and car bodies.

Small hand models and units with curved vacuum pads are available for special lifting and handling jobs. The company offers to design units to meet specifications for special usages and weights. Standard units are available with single, twin, and multiple heads. Lift bars are available for use with fork lift trucks. *International Staple & Machine Co.*

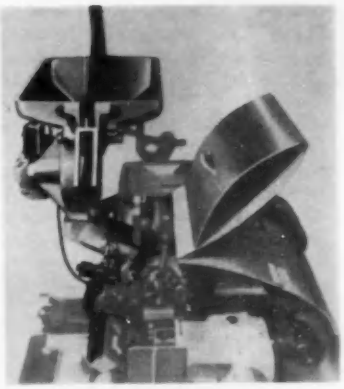
Circle 66 on postcard for more data



Vac-U-Lift, a product of Blakeslee Mfg. Co., is sold by International Staple & Machine Co.

Loader for Automatics

THE Auto-Load hopper-feed mechanism automatically feeds second operation parts into a Brown & Sharpe automatic screw machine. A screw machine so equipped can feed, locate, machine and eject a wide variety of small pieces with the same fully automatic ease as bar stock. For second operation work, the machine can use the front and rear cross slides and six turret positions. With the mechanism still attached, a simple changeover quickly changes the machine to bar stock work. *Hi-Shear Rivet Tool Co.*



Auto-Load comes complete with all parts, for models 0G, 00G and 2G B & S machines.

Circle 67 on postcard for more data

Guide Bushing

SMALL toe clamp type guide pin bushings for standard and small die sets were developed for use where mounting space is limited. With bronze electroplated on hardened steel, strength is combined with free, smooth action to eliminate seizing and scoring. They are pre-finished on the inside diameter before assembly. Dimensions remain the same after assembly because the bushings are wring-fit in the die and securely held in position by specially designed retainers. *Lamina Dies and Tools, Inc.*

Small guide bushings.

Circle 68 on postcard for more data

MATERIALS AND PROCESSES: SEALS, ALLOYS, CLEANERS

Seal Rings

Tetraseal trade-names a broad line of rectangular section, critically-toleranced rings for low-cost, leak-proof, durable sealing of most static and some moving applications. The seals are non-laminated and have accurately formed edges. Cross-sectional tolerances can be held to ±.004 in. and in many cases closer dependent upon inside and outside diameters, on size of cross-section, and on specification of material desired. Diametral tolerances held in most cases are ±.005 in. from ¼ in. OD up to 3½ in. OD, and ±.008 in. from 3½ in. OD to approximately 8½ in. OD. They are available in materials meeting MIL, AMS, and commercial specifications. *Goshen Rubber Co.*

Circle 69 on postcard for more data

Fabric Backing

Non-woven backing fabric, Lantuck-NR, which will give automobile and furniture upholsterers greater flexibility in tailoring and fitting, was announced recently. The new product will stretch in all directions under stress and spring back to its original shape when conditions have returned to normal. Made of random nylon and rayon fibers bonded together, the material was specifically designed as a reinforcement for vinyl films and coatings. *Lantuck Div. of Wellington Sears Co.*

Circle 70 on postcard for more data

Porous Aluminum

Porous aluminum and aluminum alloys with controlled ultra-fine pore size have now been made. Test samples of the new porous light metal are being offered for evaluation and determination of applications.

The new material can be made in a range of thicknesses in excess of 1/32 in. Various type porous sheet aluminum made thus far reveals pore openings of from five microns for the finest grade to 150 microns for the coarsest, all with unusually uniform porosity. A wide range of flow capacities for liquids and gases is possible. *Micro Metallic Corp.*

Circle 71 on postcard for more data

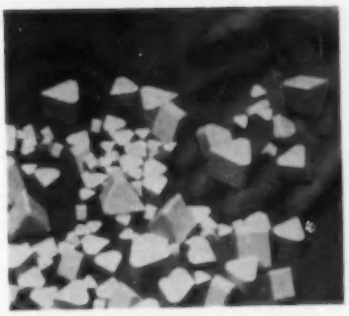
Removes Cyanide Carbonate

Carbonate remover Wes-X 150 has been developed for use in any proprietary alkaline cyanide plating process in which removal of carbonates is desirable. The new carbonate remover precipitates carbonates in exchange for cyanide ions. It also assists in the elimination of certain contaminants. The material can be used in conjunction with hydrated lime to maintain optimum concentrations of hydroxide and free cyanide without alkali metal cyanide or hydroxide additions. It is an ideal source of cyanide ions when complexing metal cyanides in both sodium and potassium types of plating solutions. *Westinghouse Electric Corp., Electroplating Projects Dept.*

Circle 72 on postcard for more data

Barrel Tumbling Media

Pebs, the triangular shaped, ceramic, barrel tumbling media, are now available in a new smaller size, according to information released by the manufacturer. This new small-sized Peb considerably extends the range of usefulness to which Pebs may be applied. Using the new



smaller size, fine finishing work can be more easily accomplished. By selecting the proper size, the "lodgement" hazard, encountered when conventional random shaped natural or synthetic stone chips lodge in holes and slots, is eliminated. This also eliminates the necessity for an extra operation to remove the lodged material. *Crown Rheostat and Supply Co.*

Circle 73 on postcard for more data

Round Lead Anodes

A new round lead anode for use in chromium plating baths is designed to give better current distribution over the entire anode area. It is said to permit faster plating, better chromium coverage and the use of higher current densities. Made of virgin tin and lead, it reportedly eliminates selective corrosion caused by foreign metal inclusions. This alloy is suitable for use in all chrome solutions; other alloys are available on request. *Hanson-Van Winkle-Munning Co.*

Circle 74 on postcard for more data

Aluminum Alloy

A non-heat treatable aluminum alloy—designated 5083 and developed to compete with mild steel in fabrication and welding costs—is available in "O" and H-113 temper plate ranging in gage from 0.250 to 2 in. and standard lengths in widths from 12 to 90 in. Nominal composition of the alloy is 4.45 per cent magnesium, 0.8 per cent manganese, 0.1 per cent chromium and the balance aluminum. It features good weldability using the semi-automatic process, at high speeds with inert-gas arc welds having an ultimate tensile strength of 42,500 psi. Joint efficiencies vary from 75 to 100 per cent depending on temper of parent metal.

During tests, superior quality welds were obtained at high speeds in all positions of welding. No pre-heating was necessary and distortion presented no problem. Less skill was needed on the part of the welder than with some other aluminum alloys. *Kaiser Aluminum & Chemical Corp.*

Circle 75 on postcard for more data

Alloy Cast Irons

Rezistan Irons are a series of patented cast iron alloys which are said to offer high tensile strengths, impact strengths and wear resistance, and improved corrosion resistance. They contain chromium, nickel, copper, molybdenum and aluminum in a range of compositions which allow the properties to be varied widely. *Uniworld Research Corp. of America.*

Circle 76 on postcard for more data

Parting Agent

Lunn-Lease, a spray film-forming plastics mold release agent, provides a uniform, durable finish which is non-tacky and non-marking. After curing, the product is quickly and easily removed without sticking. Other advantages are: it curbs bridging, imparts high gloss, and is effective in 0.001-in. film thickness. Developed by Lunn Laminates, Inc., it is distributed by *Arrow Sales & Service.*

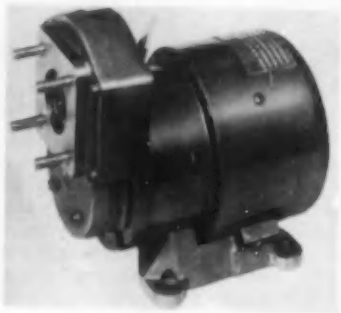
Circle 77 on postcard for more data

NEW AIRCRAFT PRODUCTS

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Electric Motors

Gearhead and direct drive motors for aircraft are available, meeting requirements of specification MIL-M-7969A. They are designed to drive



such equipment as pumps, compressors, flaps, landing gear and armament accessories. The motors are supplied in frame sizes of 2½, 3⅛, and 4 in. O. D. They are fan cooled, explosion proof, and totally enclosed.

Gearhead motors are available for speeds of 5600, 7300, and 11,300 rpm and with 29 gear reduction ratios ranging from 2.00:1 to 9.00:1. Continuous duty ratings for motors operated between 1050 and 3000 rpm are from 1/6 to 2½ hp, but higher ratings are available for motors in intermittent duty applications. The new motors are designed for 200-v, three phase, 400-c electrical systems.

The new direct drive motors are supplied in sizes having continuous ratings from 1/12 to 2½ hp at speeds of 5600, 7300, and 11,300 rpm. Higher ratings are available for motors in intermittent duty applications. The new series of direct drive motors can be supplied in all ratings for 200-v, three phase, 400-c electrical systems, and in a majority of ratings for single phase systems. *Westinghouse Electric Corp.*

Circle 26 on postcard for more data

Liquid Sensor

A liquid-sensing unit that detects presence of liquid in 0.4 sec and absence of liquid in 0.5 sec is being manufactured. It consists of an electrically powered probe containing a thermistor, a power-control package, and cable. Control unit can be obtained in either explosion-proof or vapor-proof models. The sensing element has no moving parts. No electrical contact is made with the liquid. The unit will operate in a liquid temperature range of −319 F to +200 F and can be applied to almost any type of liquid system. *Air Associates, Inc.*

Circle 27 on postcard for more data

Tachometer Generators

Development of tachometer generators capable of operation in ambient temperatures as high as 450 F has been announced.

The new generators, designated

H60-164, are two-pole three phase units designed to meet military specifications MIL-G-9398. Output at 4200 rpm with a wye-connected load of three 40-ohm resistors is 21 v, plus or minus ½ v. Features include use of separable type ball bearings specially heat treated for high-temperature operation, stators incorporating Teflon insulated magnet wire, electric connectors of new high-temperature materials, and greases with a temperature range of +525F to −90F. *Jack & Heintz, Inc.*

Circle 28 on postcard for more data

Tape System

A portable magnetic tape recording system for airborne collection of test data has been developed to perform under extremely adverse en-

vironmental conditions and permit simultaneous recording of great quantities of data during a single flight. It is said to operate unattended aboard airplanes and guided missiles at distances well beyond the effective range of telemetering equipment.

The system, packaged in individual, compact, modular units, includes a recorder, amplifiers and modulators, a calibrator, a time-code generator, and remote-control power supply. A playback unit has been developed as part of Datatape.

The recorder unit will store 28 tracks of information on 1¼-in. tape, providing 24 data channels and 4 auxiliary channels, including a microphone input. It has a standard tape capacity for 43 minutes of recording.

The recording system operates with less than one per cent error, using pulse-duration modulation (PDM) or compound modulation (CM). Error is less than three per cent using wide-band frequency modulation (FM). *Consolidated Engineering Corp.*

Circle 29 on postcard for more data

Continued on Page 96

Free INFORMATION SERVICE

Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.

USE THIS POSTCARD

FREE LITERATURE

Automatic Loading 1

Opportunities Through Automation is the title of a 20-page brochure which illustrates typical examples of standard, transfer and special machines equipped with mechanisms for automatic loading and unloading of workpieces. Not restricted to the very large plants, medium and small companies can also benefit by increased production on machines tooled for work handling, simplified operations, less floor space, increased safety factors, etc. *Ex-Cell-O Corp.*

Aviation Pulleys 2

Standard AN and NAS series aircraft pulleys of Insurok laminated and molded plastics are dimensioned and specified in a booklet published recently. *Richardson Co.*

Shock Control 3

Detailed descriptions of mounting bases, vibration and shock controls, all of which meet JAN and MIL specifications, are covered in Catalog AB-35. *T. R. Finn & Co.*

Hand Tools 4

No. 27 in a series of complete catalogs features 85 new tools not heretofore listed plus all other additions to the complete line of mechanics hand measuring tools and precision instruments, steel tapes, steel rules, dial indicators, dial gages, hacksaws, band saws, band knives and precision ground die and flat stock manufactured by *L. S. Starrett Co.*

Electric Tools 5

More than 150 models of electric hand tools for industry are shown and priced in the 1955 Spring Catalog, 60 pages. Includes saws, drills, grinders, planers, sanders, blowers, drivers runners, shears and accessories. *Skil Corp.*

Glycols 6

Details of its 12 commercial glycols for antifreezes, surface coating, coolants, solvents, and other uses are available in a 60-page book, F-4763, from *Carbide and Carbon Chemicals Co.*

OBI Presses 7

Catalog 33 gives details of C Thirty series OBI presses of 32 to 110 tons capacity. Built to JIC standards, they feature a new air clutch-brake with single point adjustment. *Ferracute Machine Co.*

Oscillogram 8

A processing machine for oscillograms, Type 23-109, is self-contained for daylight operations on up to 250 ft of regular paper. Bulletin 1537C. *Consolidated Engineering Corp.*

Aircraft Heating 9

A comprehensive data book and catalog on combustion heating equipment shows typical installations on several types of large aircraft, includes design charts and design check lists. *Janitrol Div., Surface Combustion Corp.*

VOID After Sept. 1, 1955 **7/1/55**

Circle code numbers below for Free Literature, New Plant Equipment or New Product Information

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Readers Service Dept.

Vibration Dampers 10

A catalog giving engineering specifications and performance data for vibration, shock and noise control products is available. Bulletin K4A presents 11 different types of vibration isolating units which utilize steel springs, rubber, and cork. *Korfund Co.*

Rubber Tests 11

Adhesion, tenth in the "Language of Rubber" series telling how the rubber industry runs its tests, describes the three means of adhesion measurement most widely used, discusses factors influencing bond. Neoprene Notebook No. 63. *Du Pont.*

Electrolytic Shaping 12

A brochure titled "Automatic Electrolytic Shaping with Electronic Control" explains in detail how standard grinders, equipped with electronic control and using electrolytic salts, increases removal efficiency up to six times that of conventional grinders and at the same time saves as much as 90 per cent in diamond wheel costs. *Anocut Engineering Co.*

Gear Shaver 13

Red Ring model GCR-12-in. internal rotary gear shaving machine is described in an eight-page bulletin. Production advantages, design features and machine operation are described in detail. A typical operating cycle is described and complete specifications are given for the new machine which will shave internal gears from three to 12-in. pitch diameter, up to four diametral pitch and having face widths up to 2½-in. by either conventional shaving or a new plunge-cut process. *National Broach & Machine Co.*

USE THIS POSTCARD

Balancers 14

The improved line of Type S Dynetric balancing machines, bench type and vertical type, are illustrated and described in a new catalog, bulletin 1165. Included are accessories and applications. *Gisholt Machine Co.*

Press Welding 15

Inverted mechanical presses for a wide variety of spot and projection welding operations are shown in a short bulletin. *Expert Welding Machine Co.*

Press Rebuilding 16

Revitalizing Older Presses through Press Rebuilding, a brochure just released, illustrates and describes the specialized rebuilding facilities and techniques developed by *E. W. Bliss Co.*

Shielded Enclosures 17

A new catalog providing complete engineering and application data in the field of r-f shielded enclosures has just been published by *Ace Engineering & Machine Co.*

Boosters 18

Double-acting reciprocating boosters are illustrated and described in a four-page pamphlet. In addition to a detailed description of reciprocating booster operation, the pamphlet illustrates a basic circuit, two rapid pressure build-up circuits, two slow pressure build-up circuits, and mounting and dimensional data. *Miller Fluid Power Co.*

Layout Tapes 19

An eight-page illustrated booklet discusses the advantages of using layout tape in making up both transparent and opaque plant layouts, and gives a detailed description of the correct procedures. *Labelon Tape Co.*

Strain Gages 20

A 1955 price list for SR-4 strain gages, instruments, accessories, and cements includes specifications for all sizes and types of bonded resistance wire strain gages, and tells how to select the right gage to meet various conditions of use. *Baldwin-Lima-Hamilton Corp.*

Stainless Screws 21

Stainless fasteners, including style and size data about stainless screws, bolts, nuts, washers, rivets, AN fasteners, available body and head styles are illustrated in eight-page brochure P44A. *Allmetal Screw Products Co., Inc.*

VOID After Sept. 1, 1955 **7/1/55**

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Many manufacturers are turning to Copperweld Aristoloy Leaded Steel, "the steel with built-in productivity," to produce quality in quantity.

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For further details write for free booklet, "Load Treated Steels".

Observations

In and About the SAE Summer Meeting

By Joseph Geschelin

Free Piston

While most attention is being given to developments in gas turbines, there is a feeling that a number of research organizations are making considerable headway with free piston engine designs. As in the case of the gas turbine, the free piston engine started with large sizes. We hear now that work is being carried on with smaller sizes more suitable for vehicle installation. We hope that something more tangible will be available on this score in the future.

Gas Turbine

We have mentioned on occasion how radically the shape of power plants must change if the gas turbine were to emerge as a successor to the reciprocating engine in vehicles. This development will have the same effect upon parts suppliers. For example, instead of piston rings the gas turbine will require blading by the millions. Similarly, the familiar radiator doubtless will be replaced by special designs of heat exchangers. However, the revolution appears a long way off.

Aluminum Radiators

Discussion at the session on cooling systems confirmed what was said at a materials meeting, namely that aluminum radiators are just around the corner, possibly not more than a year away. The preferred construction, according to the experts, will be a brass core with aluminum fins, the latter being soldered to the tubes. Moreover, it is felt that this will be possible with present equipment in the main.

Smaller Wheels

Rumor persists that smaller diameter wheels for passenger cars are in the offing. We tried to find out why and who wants them. Tire producers made a heavy investment in new molds for tubeless tires only a year ago. Hence they should not be eager to change. And some of the engineers we contacted did not rush to claim credit. At the moment the only conclusion we can reach is that somewhere in the picture the stylists want smaller wheels. Apparently they carry enough weight these days to get just what they think will do the trick. Smaller wheels, it goes without saying, will produce some problems—not the least of which is the brake. If a 14-in. wheel is in the picture by 1957, we can assume there will be some radical changes in brake systems as well.

Suspension Systems

Of all major elements of the modern passenger car the suspension system has remained substantially the same for the past 20 years, except for refinements. Many designers feel the need for radical change—and Packard took one avenue in its torsion bar suspension. One of the suspension investigators told us that what is needed is an entirely new approach, employing some advanced form of servo mechanism that will be capable of feeding information to the suspension system to permit accommodation to widely varying road conditions. What the nature of the feed-back mechanism might be is a matter for speculation at this writing. However, we would not be surprised to see the emergence of more torsion bar suspensions of varying designs.

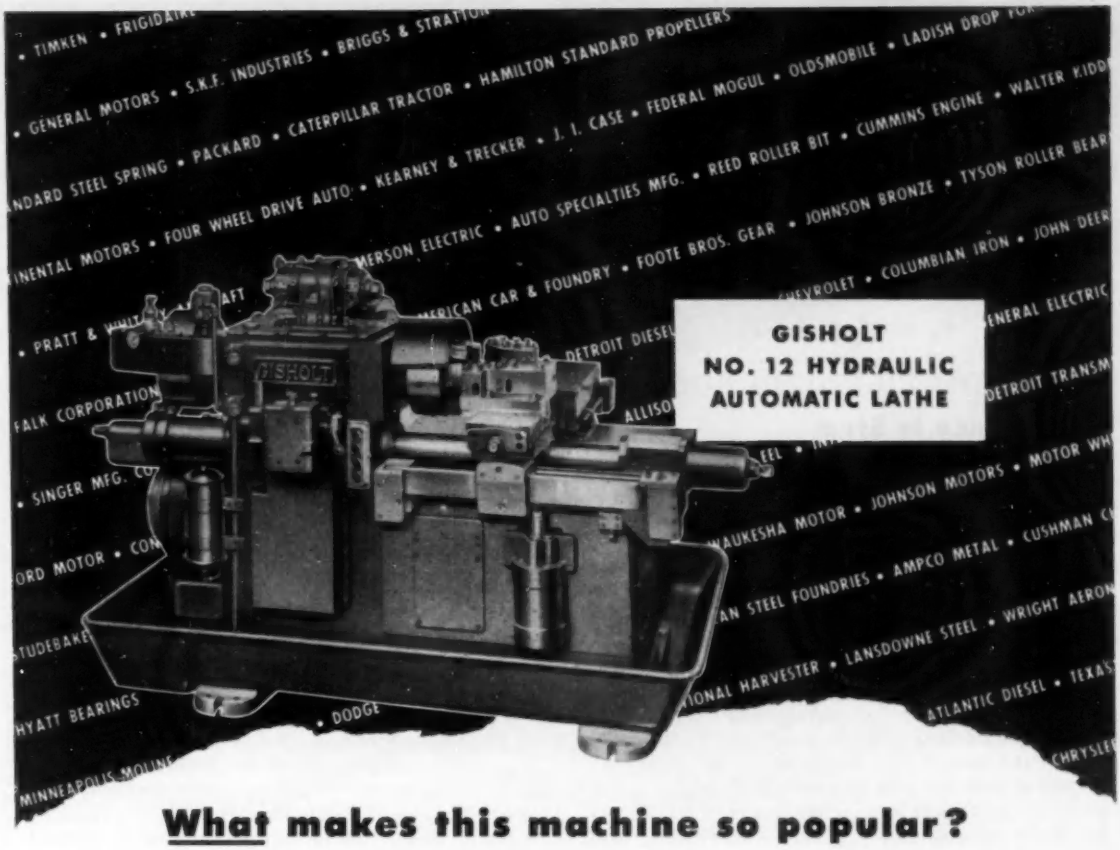
Computer Progress

Discussion of computers of digital and analog types emphasized that the so-called giant brains require more knowledge on the part of engineers, and an even better analysis and understanding of specific problems in terms of physical concepts. The impression we got was that these machines will not solve problems without a lot of thought and help from their masters.

More On Automation

Confusion persists as to the economic place of automation techniques. Perhaps a look at the situation will be of help. Here is a philosophy that has evolved from familiar mass production practices. The large and expensive transfer machines obviously are in-

(*Turn to page* 124, *please*)



What makes this machine so popular?

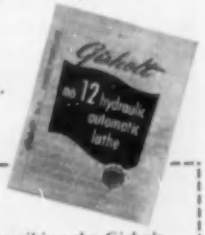
It's the simple basic application of hydraulic principles—perfected through the years. It's a single spindle machine that handles all classes of work—holding with a chuck or an arbor, with fixtures, or with a work driver for between centers. Front carriage alone will perform 14 different cycles. Independent rear slide can be positioned at any angle to the work. Feeds are infinitely adjustable...not limited by cams. Here's the versatility, the speed, the automatic cycle, and the easy change-over that mean big savings for scores of users. Why not for you?

If you have parts up to 12" to produce at lower cost, look at the Gisholt No. 12 Hydraulic Automatic Lathe. Call your Gisholt representative. Or write us.

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

This new catalog will show you why.

All operating features are clearly described, fully illustrated. Here, too, are 28 different jobs to show many classes of work and tooling possibilities. Write for your copy.



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METALS

Another Increase in Steel Capacity Foreseen. Demand for Copper Continues High. Zinc Price Rise Predicted.

By W. F. Boericke

Torrid Pace in Steel

More steel was produced in May than ever before in a single month. According to the American Iron & Steel Institute in that month the industry poured 10.3 million tons of ingots and steel for castings. It looks like a record first half for steel output. Incoming orders are still in excess of capacity. While some let-down in the terrific pace is anticipated in the third quarter as summer heat and vacations take their toll, it begins to look as if the fourth quarter would establish an all-time high.

What's back of the insistent demand that has producers worried over allotting steel fairly? No doubt some of the current pressure for deliveries is to hedge against a probable rise in steel prices which is expected to accompany any increase in steel wages. As the latter is well-nigh a foregone conclusion, consumers wherever possible are building up steel inventories to escape a subsequent across-the-board increase in steel products.

Demand Strong From Consumers Generally

This isn't the whole answer. Demand comes from nearly every segment of the economy. The automobile industry has confounded the prophets by continuing to insist on more steel. Its members declare their inventories are considered low and say they are seriously worried over their steel needs for 1956 models. Demand for cold rolled sheets fill order books for months ahead. The over-all demand for plate is strong, although spotty. Biggest call is from the construction industry, still travelling at top speed. Manufacturers of machinery are close behind. Galvanized sheets are hard to get. There's about a two-month backlog of orders for steel pipe.

Only a few weak spots show up in a survey. The foundry business is reported slow in Eastern markets. There is disappointing support from shipbuilding and the railroads, although some of the latter are now asking for more steel and faster deliveries.

Normally June reflects a lag in demand from the steel warehouses but it is now reported that they are selling all the steel they can get. Consumers who normally buy direct from the mills have been obliged to go to warehouses to fill their requirements. On top of this, there's a lot of export business that could take up any tonnage that wasn't wanted by the domestic market.

Only a year ago the steel industry was fearing it had overbuilt production facilities. Now there is talk of increasing ingot capacity again. A prominent steel executive forecasts an increase of 4 million tons per year for the next 15 years. By mid-June steel production was estimated about 97 per cent of capacity. The *Iron Age* scrap composite held steady at $34 per ton.

Controls May Be Revived For Nickel

An additional 2 million pounds of nickel has been made available to industry to relieve the shortage. This brings up the total released by ODM for June to 3 million pounds. While helpful, it does not appear this will do much to satisfy hard-pressed consumers, many of whom declare their inventories are down to less than a month's supply, with some small plating plants working with only two weeks' supply.

It appears probable there will be no real relief until 1958, although some improvement will be seen by late 1956 as new production comes in. It might mean Government control again in the interim. A committee may be appointed by Washington to advise on the need.

There wouldn't be any shortage if the Government would ease up on its stickpiling requirements, but that appears impracticable to ask. Industrial users can find no suitable substitute for nickel in making stainless steel and demand is very great. Nevertheless, it must be admitted that thus far, although seriously inconvenienced, no stainless steel plant has yet been forced to shutdown for lack of nickel.

Aluminum in Tight Supply

Aluminum is in seriously tight supply. In a series of conferences at Washington by irate consumers it appeared abundantly clear that U. S. fabricating capacity plus current Government stockpiling is considerably more than primary capacity and normal secondary output. Undoubtedly at present fabricating capacity is growing faster than primary.

The three big producers, Alcoa, Reynolds, and Kaiser, to which may be added Alcan in Canada, admit they can't supply the present industrial demand and still furnish aluminum for the Government stockpile.

(*Turn to page* 126, *please*)

LINCOLN...like many other leading engine manufacturers selects and distributes...for authorized replacement service...

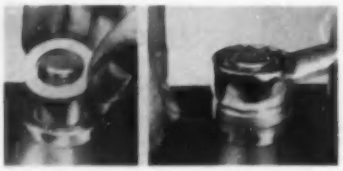
Perfect Circle

2 in 1 chrome piston rings...the standard of comparison!

NEW AIRCRAFT PRODUCTS CONTINUED FROM PAGE 88

Preload Washer

Structural bolt connections can be made lighter, tighter and longer-lived by a preload indicating device called PLI washer. Two concentric steel rings, one of which is compressed as the bolt is tightened, provide an accurate means for tighten-



ing bolts to predetermined preloads as high as 80 per cent of bolt yield strength. In fatigue tests, bolts preloaded with PLI washers lasted as much as fifty times longer under dynamic load without failure than similar bolts tightened to the minimum preload to be expected from torquing.

The washer was developed for its own use by Douglas Aircraft Co., Inc. Under sole license the maker has continued development work on the washer to produce a complete range of sizes for a wide variety of aircraft and industrial bolt types.

The PLI washer, which becomes an integral part of a nut and bolt assembly, can be used at either end of a connection. In photo at left, installed at nut end of connection, PLI washer is being sandwiched between two auxiliary washers. As nut is tightened down on PLI washer assembly, the inner ring takes the load. Continued tightening first elastically and then plastically compresses the inner ring. The outer ring is free to move until the inner ring is compressed to the point where the adjacent washer bottoms on the outer ring. At this end point the outer ring binds and the desired preload for the bolt is reached. To detect the end point, as shown in photo at right, the operator wiggles the outer ring by means of a feeler handle—actually a disposable length of thin gage wire—inserted into any one of three holes provided on the outside of the ring. *Standard Pressed Steel Co.*

Circle 30 on postcard for more data

Self-Cooled Servo

Self-cooled servo Series 5100-2237 weighs only 3.188 lb. The servo motor alone pulls as much as 1/15th hp at 600 rpm and has 22 in.-oz of stall torque. Overheating of the servo motor is prevented by a blower which functions independently yet is an integral part of the servo. The device is designed to drive an antenna on airborne military radar or for similar applications. The series receives a 100 per cent final inspection.

The servo motor is a two-phase 115-v 400-c motor with a no load speed of 10,000 rpm and a full load speed of 6000 rpm. Stalled power input is 150 watts per phase. *John Oster Mfg. Co.*

Circle 31 on postcard for more data

Jet Analyzer

Testing of a jet engine in or out of the plane is now possible with the J Model of the Jetcal Analyzer. The test of the exhaust gas temperature thermocouple circuit is made without running the engine or disconnecting any wiring, with accuracy guaranteed to ±4 C at engine test temperature. A group of specially designed probes, each containing a furnace developing a precisely controlled temperature up to 900 C and a thermocouple of its own, fits over the thermocouple in the jet engine. The potentiometer in the Jetcal Analyzer measures the temperature picked up by the thermocouples in the probes, concurrent with the temperature reading of the cockpit instrument. The thermocouples in the heater probes are of Bureau of Standards accuracy. Incorporated in the analyzer is the Takcal, which checks and trouble-shoots the aircraft tachometer system and is accurate to within ±0.1 per cent rpm. The Takcal is a frequency device that is voltage insensitive and retains its absolute accuracy through all temperature ranges. *B & H Instrument Co., Inc.*

Circle 32 on postcard for more data

Drain Valve

A flush mounting drain valve for use with integral aircraft fuel tanks, called Type 5407, is now in volume production.

The assembly consists of an aluminum-alloy flanged body with an internal O-ring-seated piston which is held in the closed position by a compression spring. The body is inserted in a countersunk hole in the lower wing skin. A spacer with cross-drilled drainage holes is then dropped over the valve body and beds down against upper surface of the lower wing skin. An Elastic Stop Nut, with fuel-proof nylon insert, is then tightened down over the valve body against the upper surface of the spacer. Modification of the basic valve body can accommodate wing skins of any thickness. These valves are designed for operation in ambients of —65 to 160F. Proof pressure is 50 psi; weight 0.077 lb. *Allen Aircraft Products, Inc.*

Circle 33 on postcard for more data

Constant Speed Motor

Hydraulic motors having integral speed control for constant speed applications are designated series MRO.

Speed of rotation of the conventional hydraulic motor is maintained within plus or minus three per cent of a pre-determined setting.

The new assembly consists principally of a valve plate and speed regulator valve sub-assembly combined with a conventional aircraft piston type fixed displacement hydraulic motor. They are presently available in sizes rated (at nominal rpm) from 2.3 to 18 hp. The smaller motors operate at recommended continuous speeds of up to 6000 rpm and at intermittent speeds of up to 9100 rpm. at 3000 psi continuous duty. *Vickers, Inc.*

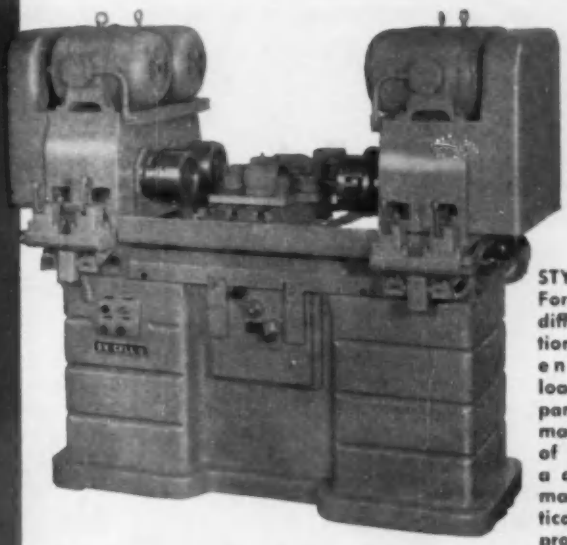
Circle 34 on postcard for more data

High-Temperature Hose

Prototype high pressure hydraulic hose is designed to operate at 3000 psi and withstand all presently known synthetic or petroleum-based hydraulic fluids as well as those which may yet be developed at temperatures over 400 F. Fluoroflex-T YR700 hose sizes now available for field testing are ⅜ in. and ½ in. *Resistoflex Corp.*

Circle 35 on postcard for more data

STYLE 2112-A. Single-end model for work pieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of multiple operations.



STYLE 1212-A. For identical or different operations at each end. When loading time of parts approximates the time of machining, a double-end machine practically doubles production.

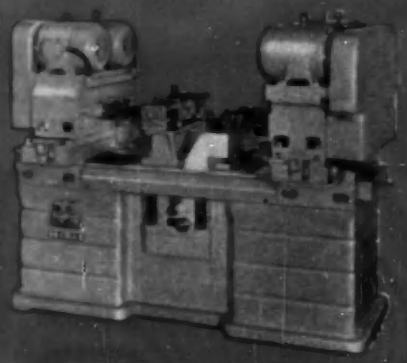
STYLE 112-C. Large and sturdy with long stroke. Accommodates medium and heavy work, gives maximum precision production, minimum operating cost.

WHICH MODEL FITS YOUR PRODUCTION?

Ex-Cell-O Precision Boring Machines

XLO

EX-CELL-O for PRECISION



STYLE 17. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be tooled for a wide range of production jobs.

You can precision-bore, turn, face, counterbore, chamfer, or groove with these fast, sturdy, flexible EX-CELL-O machines.

These are standard machines that handle many kinds of precision operations. EX-CELL-O has the *standard items of tooling* to make this possible at minimum cost.

Any EX-CELL-O Precision Boring Machine will give you *precision work at maximum production* speeds, with a minimum of investment.

Get all the facts about them from your local Ex-Cell-O representative, or write for a Precision Boring Catalog.

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

55-18

Effects of *Rain Erosion* on Aircraft Surfaces

AT SUPERSONIC SPEEDS

Specimens which have been fired through 500 ft of simulated rainfall at speeds of 1520 miles an hour

AMONG new problems faced by design engineers of supersonic aircraft and missiles is the destructive effect of rain. At transonic and supersonic speeds, rain erosion of aircraft materials should prove to be a limiting factor in all-weather flying conditions. Survival time for some materials is only a matter of seconds.

In order to determine the best materials for missiles and aircraft, the Convair Division of General Dynamics Corp. at San Diego has developed a unique ballistics method of testing specimens. Tests are conducted under controlled rain conditions up to speeds of 1900 mph, approximately Mach 2.5.

Test specimens are mounted in the nose of a modified 20-mm projectile and fired horizontally from a standard 20-mm aircraft cannon through simulated rainfall. Upon firing, a tracer element in the projectile is ignited and burns for approximately ¾ second. A black powder separation charge then ignites and expels the test specimen and parachute. Opening loads on the six inch vented-canopy nylon parachute are 500 lb. This load checks the forward velocity of the specimen within 10 ft. Parachute and specimen land about 1500 ft from the firing point. Speed of the projectile can be varied from Mach 1.0 to Mach 2.5 by controlling the main powder charge.

Convair is testing projectile heads of metal, plastics, or ceramics.

Rainfall is simulated by a 500-ft sprinkling system installed on Camp Elliott property near San Diego. The sprinkling system, operated by a portable pump, consists of a single horizontal row of pipe mounted three feet above the ground. Spray nozzles are installed at 10-ft intervals along the pipe. This produces a continuous uniform rainfall rate of two inches per hour with an average rain drop diameter of two mm.

After firing about a dozen rounds, engineers search the drop area and retrieve the miniature parachutes and specimens for evaluation. In rare instances a projectile overtakes the parachute after it is released, tearing it to shreds. Average recovery rate is 95 per cent. Specimens are re-fired until complete data are obtained. Parachutes can be re-used about six times.

The rain erosion project is being conducted for the Wright Air Development Center Materials Laboratory.

• • •

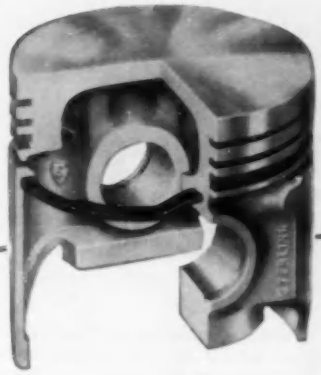
Many Exhibits, Good Attendance Feature MPA National Meeting

Quite recently, in Philadelphia, the Metal Powder Association held a very successful and well-attended national meeting. Included with the 11th Annual Conference was an exhibition staged by 25 companies in the powder metallurgy field. Products shown ranged from basic powders and powder products to presses and furnaces.

Numerous papers were presented at the technical sessions, which were divided into a general session and an electronic one. There appeared to be a great deal of interest in titanium powder metallurgy, threaded cores, and the iron powder industry in Europe.

In addition to the technical meeting and the show, the association members elected new officers for the fiscal year. Morris Boorky, president of Presmet Corp., was elected president.

B. T. duPont, sales manager of Plastic Metals, Div. of National-U. S. Radiator Corp., was chosen chairman of the board. Vice-presidents of the organization include: R. D. Ponemon, general manager of Pyroferric Co., Inc.; E. H. Klein, manager of the Metal Div. of New Jersey Zinc Sales Co.; and D. L. Almquist, Stackpole Carbon Co.



1953 **STERLING introduced a new, amazing piston**

1954

ONE car manufacturer selected the new piston

1955

7 Manufacturers specify STERLING CONFORMATIC* PISTONS

In 1956... there will be more! This quick acceptance by automotive engineers is a result of the demonstrable superiority of Sterling Conformatic Pistons. Sterling Engineers will be glad to show you how Conformatic Pistons can improve your engine's performance. Conformatic eliminates cold slap, scuffing and frictional power losses... because it conforms exactly to the cylinder walls over the entire operating range. Your Sterling Engineer can give you complete details and arrange a test.

***Now* LOW-COST**

RING LAND PROTECTION

in Sterling* CONFORMATIC *Pistons

Ring grooves lined with lightweight intra-cast steel inserts give Sterling Conformatic Pistons even longer life... greater efficiency. An optional feature for truck and passenger car pistons.

STERLING ALUMINUM PRODUCTS INC.
ST. LOUIS, MISSOURI

*TRADE NAME REGISTERED

News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Continued from Page 39

ACF-Brill Motors Predicts Profit for 1955 Operations

Although it had a net loss of $54,657 for the first quarter of 1955, ACF-Brill Motors Co. expects to end up the year with a profit, according to a statement made at a recent stockholders' meeting. Operations of the former bus manufacturer are now mainly confined to a Government contract of about $3 million. The company now has no real plant or machinery of its own, but it does provide management and engineering services while subcontracting production.

It was pointed out that the company has a number of loans and leases outstanding on buses made while it was still in the bus manufacturing business. In addition, the concern is said to have nearly $6 million in cash among its assets.

Storage Area Expanded By AC Spark Plug Div.

Latest expansion by AC Spark Plug Div. of General Motors Corp. will give it a total of 2.3 million sq ft of floor space in Flint, Mich. AC is expanding its storage and warehousing facilities at a new plant it acquired under a five-year lease from Palace Corp., a house-trailer building concern. The plant will provide AC with an additional 120,000 sq ft of floor space.

The expansion is in line with the accelerated production pace at AC to meet demand by automobile companies. Sales of some lines of products, AC notes, are materially higher than during the peak year of 1954. AC employment, including that at Flint and two Milwaukee plants, now totals about 17,000 persons.

Weekly Wages At Ford Hit Peak in Quarter

Average weekly earnings of hourly employes at Ford Motor Co. hit a record during the first quarter. According to the company, employes worked an average of 45.3 hours a week and earned an average of $106.67 a week.

Fawick Appointed Licensee To Produce Girling Brakes

Fawick Corp. has been licensed to manufacture and sell Girling brakes in the U. S. It is claimed that the two-leading-shoe unit with sliding shoes provides progressive action and a 50 per cent reduction of brake "fade" characteristics.

A subsidiary of Joseph Lucas Industries Ltd., and the largest manufacturer of brakes in the United Kingdom, Girling has also developed the autostatic two-trailing-shoe brake. The unit is said to have low sensitivity to temperature fluctuations.

The heavy-duty Girling brake for commercial vehicles may be supplied either as air or hydraulically actuated. In addition, a mechanical brake may be incorporated in the unit to permit mechanical applications of the service brakes to the rear axle(s) for emergency or parking brake needs.

In addition to Girling brakes, the agreement also covers the manufacture and sale of master cylinders, wheel cylinders, hydraulic brake hose, slave cylinders, transverse and pusher cylinders, hand-brake controls, and all equipment required for complete brake and actuator installations.

Many Papers and Exhibits To Feature Atomic Congress

U. S. and foreign engineers, along with scientists and industrial representatives, will present nearly 300 papers in 50 sessions in one week on practically every phase of peacetime uses of atomic energy and its by-products at the forthcoming Nuclear Engineering and Science Congress in Cleveland, O. The event will be held from Dec. 12 to 16.

While technical sessions are underway at the Cleveland Public Auditorium, leading U. S. and foreign industrial concerns will display their equipment and knowledge at the first International Atomic Exposition in the building's five exhibit halls. Reactor models will be among the exhibits to be featured.

(*Turn to page* 104, *please*)

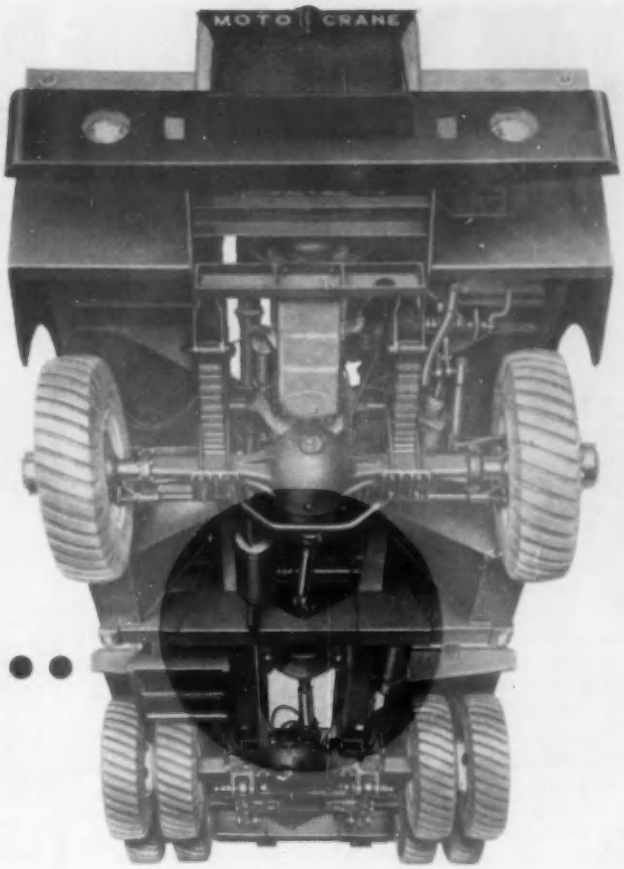
SOUTH ATLANTIC AND PACIFIC SECTIONS SHOW BIGGEST GAINS OVER LAST YEAR

Regional Sales of New Passenger Cars

Zone	Region	April 1955	March 1955	April 1954	Four Months 1955	Four Months 1954	Per Cent Change: Apr. over March	Per Cent Change: Apr. over Apr. 1954	Per Cent Change: Four Months 1955 over 1954
1	New England	42,560	34,101	32,567	126,388	99,564	+24.48	+30.66	+26.91
2	Middle Atlantic	136,383	132,881	106,533	426,919	334,255	+ 2.65	+28.02	+27.72
3	South Atlantic	73,124	75,085	55,660	271,476	197,114	− 2.61	+31.38	+37.73
4	East North Central	169,609	167,569	132,626	585,892	446,850	+ 1.21	+27.89	+26.04
5	East South Central	29,742	33,004	23,706	108,409	84,359	− 9.88	+25.46	+28.51
6	West North Central	61,660	58,858	56,810	188,553	166,635	+11.89	+ 7.00	+13.15
7	West South Central	55,351	42,030	40,729	170,994	156,873	+31.69	+35.90	+11.41
8	Mountain	20,926	18,197	15,322	64,179	49,926	+15.00	+36.57	+28.55
9	Pacific	72,399	74,719	44,996	251,570	190,783	− 3.24	+60.88	+56.47
	Location Not Determinable			145		744			
	Total—United States	661,858	630,934	508,102	2,100,371	1,699,123	+ 2.41	+28.29	+29.32

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Cal., Ore., Wash.

to BENEFIT the BUYER MOST...

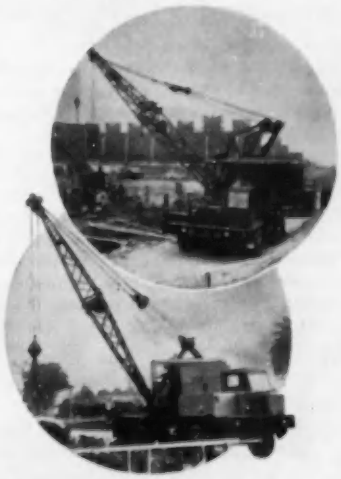


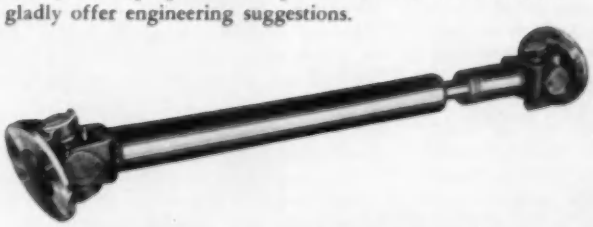
Lorain provides dependable BLOOD BROTHERS propeller shafts

Speed, economy, mobility—all benefit truck-crane users. But *most* essential is *dependability*, which protects the owner's profits.

On these rugged Lorain Moto-Cranes, the Thew Shovel Company assures *outstanding* dependability . . . right down to specifying Blood Brothers Propeller Shafts. Over the years, they've proved their ability to transmit heavy torque loads despite the toughest on-or-off-the-road conditions—to benefit the buyer *most!*

If *you* have universal joint or propeller shaft problems, write or call Blood Brothers. We'll gladly offer engineering suggestions.





BLOOD BROTHERS MACHINE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
ALLEGAN, MICHIGAN

UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

Three Cars Average Over 100 Miles Per Hour

IN LE MANS RACE IN FRANCE

By W. F. Bradley
Special European Correspondent
for AUTOMOTIVE INDUSTRIES

LE MANS, FRANCE

At the start of the Le Mans 24-hour race, Castellotti, driving one of the big 268 cu in. Ferraris which have the most powerful engines of any cars entered, drew away until he had a quarter of a mile lead on the others. Hawthorn's Jaguar was at the head of the group, Magioli third in a Ferrari and Walters in Briggs Cunningham's Jaguar in place. The Mercedes cars had made a poor start, but soon after the first hour when the speedy Ferraris showed that they were spent, Fangio crept up and threatened Hawthorn and for several hours these two battled for first place, first the Englishman, then the Argentine taking the lead by a very narrow margin.

After the disaster during the third hour, when a Mercedes driven by Pierre Levegh ploughed into the spectators, killing 82, real interest in the race vanished, although the other Mercedes entries continued and the lap record and the flying kilometre record were broken again and again. Castellotti covered the flying kilometre at 175.3 mph and a complete lap at 117.7. If his kilometre time was never equalled, Fangio soon put the lap record up to 118.1 mph, then to 120.3. Hawthorn carried it to 120.8. Fangio stepped it up to 121.3 and then to 121.4, and finally Hawthorn got the record of the day with 122.38 mph for the 8.3 miles of the road circuit.

At 2 o'clock on Sunday morning it was possible to get a phone message through from Germany ordering team manager Neubaurer to withdraw the Mercedes cars as a sign of mourning. They then had a lead of two laps over the Jaguar.

With the German team out, the Ferraris spent after their initial effort, the Maseratis only short lived and two of the official Jaguar cars suffering from mechanical defects, there was no further interest in the race, Hawthorn made a magnificent display during his duel with Fangio and later in the race, but it is doubtful if the Jaguars could have beaten the Mercedes had there been no accident. The Mercedes flap brake appeared to give excellent results. Not only was it used at the end of the straightaway, where speed had to be dropped from the maximum of around 170 mph to the minimum of 40, but it was brought into play on the grandstand stretch, where speed had to be lowered from about 120 mph to 90.

For the first two hours Cunningham's Jaguar performed well, holding fifth or sixth position; then during the fourth hour it was at the rear and a little later had to be withdrawn enveloped in steam and oil. Cunningham's own car ran regularly, but never got better than 20th position. Then it became impossible to use the low gears, which were constant mesh type with synchronizing clutches, for if the lower ratios were engaged they could not be released. Cunningham ran in high for 10 hours, but had to withdraw two hours before the end.

For the first time three cars averaged more than 100 mph. Another feature was that the aircooled Porsche, of only 88 cu in. displacement came very near this figure and three cars of this make were in the first six. Of the 60 starters, 39 failed to finish.

The 60 cars brought to the line for the race represented production sports models differing only slightly from those sold to the public and also prototypes having a close affinity with racing machines and in some cases having a higher speed ability than the racers built under the International 2½ litre formula. An important distinction is that under the rules straight gas or a mixture of gasoline and benzol and alcohol has to be used, all tools and spares required during the race must be on the car at the start, all accessories must be in working order, and gas and water

(*Turn to page* 125, *please*)

Results of Le Mans 24-Hour Race

	Distance	Average
1. Jaguar 210 cu in., Hawthorn and Bueb	2564.5 m	107 mph
2. Aston-Martin 178 cu in., Collins and Frere	2530.8	105.4
3. Jaguar 210 cu in., Claes and Swaters	2477	103.1
4. Porsche 88 cu in., Polensky and Frankenberg	2380.2	99.3
5. Porsche 88 cu in., Seidel and Milhoux	2308.7	96.2
6. Porsche 88 cu in., Glocker and Jukan	2276	95.2
7. Bristol 122 cu in., Wilson and Mayer	2270.6	94.6
8. Bristol 122 cu in., Keen and Line	2262.6	93.6
9. Bristol 122 cu in., Wisdom and Fairman	2245.8	93.5
10. Frazer Nash 122 cu in., Becquart and Stoop	2178.6	90.6
11. Osca 90 cu in., Cabianca and Scarbati	2143	89.2
12. M. G. 90 cu in., Miles and Kickett	2084	86.8
13. Porsche 88 cu in., Duntov and Veuillet	2052.7	85.3
14. Triumph 122 cu in., Dickson and Sanderson	2027.7	84.5
15. Triumph 122 cu in., Richardson and Hadley	2027.6	84.4
16. D. B. 45 cu in., Cornet and Moujin	1974.6	82.1
17. M. G. 90 cu in., Lund and Weffler	1961.2	81.7
18. Porsche 88 cu in., Olivier and Jeser	1960.6	81.6
19. Triumph 122 cu in., Brooke and Goodall	1793	74.7
20. D. B. 45 cu in., Hery and Trouis	1749	72.8
21. Cooper 67 cu in., Wadsworth and Brown	1732.7	72.2

Winners on formula: Porsche 1241 points; Jaguar 1232; Aston Martin 1226.
Thirty-nine cars failed to run for 24 hours.

COMPLETE *Finishing* SYSTEMS

. . . for ENAMELS • LACQUER • PAINT • VARNISH

Interior of Mahon Pressurized Tack-Off Enclosure at entrance to Finish Coat Spray Booths. Spray Booth is visible in rear.

Mahon Dry-Sump, Down-Draft, Hydro-Filter Spray Booth with Remote Sludge Tank and Automatic Sludge Unloader.

. . . the EXPERIENCE that goes into the PLANNING and ENGINEERING of MAHON EQUIPMENT is the item of GREATEST VALUE to YOU!

Over four thousand five hundred feet of conveyor carries automobile bodies through the various finishing operations in this Complete Mahon Single Production Line Finishing System.

Mahon Down-Draft Deadener Booth. Clean Filtered Air is supplied from above—Fumes are drawn down and out at bottom.

Mahon Dry-Off Oven with Cooling Tunnel at Exit End. Finish Baking Ovens are Similar with Multiple Controlled Heat Zones.

WHY Do So MANY Manufacturers BUY Complete MAHON FINISHING SYSTEMS?

The answer to that question is very simple. In the first place, they want Mahon *KNOW-HOW*. In the second place, they want their entire finishing system planned, coordinated, engineered and installed by one responsible organization. In other words, they want one responsibility for final results—which are the quality and the cost of the finish on a product. Many things enter into these two end result items . . . most important are the operating efficiency and the operating cost of the finishing equipment. Most manufacturers have found that this is where the true worth of Mahon equipment shows up . . . it isn't built to a price, it is built to do a job. If you have a finishing problem, or are considering new finishing equipment, you, like thousands of other manufacturers, will find that Mahon engineers are better qualified to advise you on both methods and equipment requirements . . . and better qualified to do the all-important planning and engineering of equipment —which is the key to fine finishes at minimum cost. You will find also, that Mahon equipment is built better for more economical operation over a longer period of time—a factor to be weighed carefully when comparing initial cost figures. Mahon will do your complete job on one contract . . . undivided responsibility for the entire system insures proper coordination and safeguards you against complications which can upset your production schedules. See Mahon's Insert in Sweet's Plant Engineering File for information, or write for Catalog A-655.

THE R. C. MAHON COMPANY

HOME OFFICE and PLANT, Detroit 34, Mich. • WESTERN SALES DIVISION, Chicago 4, Ill.

Engineers and Manufacturers of Complete Finishing Systems—including Metal Cleaning, Pickling, and Rust Proofing Equipment, Hydro-Filter Spray Booths, Dip and Flow Coaters, Filtered Air Supply Systems and Drying and Baking Ovens, Cooling Tunnels, Heat Treating and Quenching Equipment for Aluminum and Magnesium, and other Units of Special Production Equipment.

MAHON

AI TABLOID

(Continued from page 37)

Minneapolis-Honeywell Regulator Co., Northern States Power Co., and General Mills, Inc., have entered into a joint undertaking in the field of atomic energy.

* * *

Pioneer-Central Div. of Bendix Aviation Corp. has launched a broad expansion program by construction of a 12,000 sq ft addition to its Davenport, Ia., plant . . . Goodyear Aircraft Corp. is building a new $3 million engineering and research building at Akron, O.

* * *

Timken Roller Bearing Co. recently received a citation from The American Society for Materials Handling for the best installation of a materials handling system in production in Northeastern Ohio.

* * *

Kaiser Metal Products, Inc., has been awarded a $10 million contract to produce additional B-57 wings for Glenn L. Martin Co. . . . Bell Aircraft Corp. has begun delivery of components for the B-52 Superfortress.

* * *

Merit Machinery, Inc., has been appointed exclusive distributor in Western Pennsylvania, West Virginia, and Northwest Maryland for Kingsbury Machine Tool Corp. of Keene, N. H.

* * *

Birdsboro Steel Foundry & Machine Co. is building a $2 million specialty bar mill for Northeastern Steel Corp.

* * *

Piasecki Helicopter Corp. has proposed the development of helicopter "fire trucks" to fight aircraft and other fires inaccessible to present ground fire trucks.

* * *

Firestone Tire & Rubber Co. has established a Synthetic Rubber and Latex Div. . . . Hickok Mfg. Co. has organized an Automotive Safety Div.

* * *

J. P. Dunnett and Associates is name of new electronic engineering firm at 18520 Conant, Detroit, Mich. . . . Roadable Corp. has been formed in Tonawanda, N. Y., to develop an aircraft with folding wings that will double as a ground vehicle.

Convair Div., General Dynamics Corp. —Ralph L. Bayless is now chief engineer of Convair-San Diego.

MEN *in the* NEWS

(Continued from page 41)

Behr-Manning Div., Norton Co.—**Henry R. Merrill** has been appointed general sales manager.

Greer Hydraulics, Inc—**Robert P. Lord** has been made executive vice-president and treasurer, and **David Fromson** has been named secretary.

Doehler-Jarvis Div., National Lead Co.—**Ernest C. Kron** has been promoted to division metallurgist.

Chrysler Div., Chrysler Corp.—**Jack B. Huntress** has been appointed merchandising manager.

Eaton Manufacturing Co., Stamping Div.—**D. T. Hanlon** has been made plant engineer.

Chrysler Corp.—**Walter J. Simons** has been elected treasurer.

American Chain & Cable Co., Inc.—**Cyrus N. Johns** was elected chief executive officer, succeeding **Wilmot F. Wheeler**, who continues as chairman of the board; **Stanley Mann**, treasurer emeritus; and **Arthur C. Laske**, treasurer.

Bendix Aviation Corp.—**James E. Bevins** has been appointed assistant director of engineering of the Eclipse-Pioneer Div., and **C. D. Flanigen** succeeds him as chief engineer of the Utica Div.

Dodge Div., Chrysler Corp.—**Edward H. Rice** has been appointed sales manager-trucks in charge of field operations.

Vickers, Inc., Federal Contracts Sales Div.—**Charles J. Cannon** has been made manager.

Torrington Co.—**Milton E. Berglund** has been elected executive vice-president; **Lawrence W. Smith**, vice-president of manufacturing; **Byron T. Virtue**, vice-president of engineering; **Edward B. Thompson**, vice-president of sales; **William R. Reid, Jr.**, assistant secretary and general sales manager; **Floyd A. Pearce**, vice-president of finance; **Walter Hudson**, assistant treasurer; and **Ray E. White**, controller.

Industry News

(Continued from page 100)

ASC Reviews Continual Growth As Precision Spring Producer

A $13 million plant expansion and equipment modernization program, carried out since the end of WW II, has placed Associated Spring Corp. in a strong competitive position today. Speaking at a press conference in Bristol, Conn., last month, Carlyle F. Barnes, ASC president, reviewed the concern's steady growth since its founding and discussed the many applications of its precision mechanical springs and other metal components in the automotive, aircraft, electronics and other industries.

The visiting members of the press were shown through all departments of the plants of the Bristol divisions of ASC. They saw, among other operations, the forming, heat-treating, and finishing of coil, spiral, torsion, and flat mechanical springs, as well as the cold-rolling and finishing of spring steel.

GM Offers New List Of 16mm Color Films

General Motors Corp. is making available nine new 16 mm color sound films for public use. Included are: "Body Bountiful," which shows the development of an automobile body; "A Thing of Beauty," the story of how products of industry benefit by the stylist's touch; "Tomorrow and Today in Kitchens," a preview of the kitchen of the future; and "New Power for Flight," a demonstration of the turbo-prop engine.

A GM Motion Pictures Catalog for 1955-56, listing the new films and 52 others being offered, can be obtained by writing to: Film Section, General Motors Corp., General Motors Bldg., Detroit 2, Mich.

Mack Awarded New Order For 440 Diesel Buses

Mack Trucks, Inc., is the recipient of an order for 440 buses for the city of San Francisco. Valued at more than $9 million, the buses will be made of lightweight material and be powered by turbocharged Diesel engines to permit greater maneuverability over the city's steep inclines.

Each bus will be 102 in. wide and seat 48 passengers. They will have such special equipment as air suspension systems and pressure ventilation of the interior.

Simmonds

SU FUEL INJECTION SYSTEMS

Proven in Operation to Offer . . .

MAJOR FUEL ECONOMIES • INCREASED POWER OUTPUT

Simmonds Aerocessories, Inc., manufactures the only advanced type fuel injection system now in production in the U.S. for reciprocating engines up to 600 h.p. After extensive field tests on U.S. ordnance engines (where fuel economies of more than 20% were proven) SU Fuel Injection Systems are also being specified on a growing list of medium-range aircraft and helicopter engines.

Other proven advantages of the SU Fuel Injection System:

- **Overcomes major icing problems; gives improved cold starts.**
- **Eliminates the need of hot-spots and pre-heaters; simplifies manifold ducting.**
- **Provides increased power output due to removal of intake obstructions.**
- **Provides improved fuel distribution and better cylinder head cooling.**
- **Operation not affected by engine attitude.**

Complete data on SU Fuel Injection Systems available on request.

SIMMONDS AEROCESSORIES, INC.

General Offices: Tarrytown, N. Y. • Branch Offices: Detroit, Mich. • Dayton, Ohio • Dallas, Texas • Wichita, Kans. • Glendale, Cal. • Seattle, Wash.
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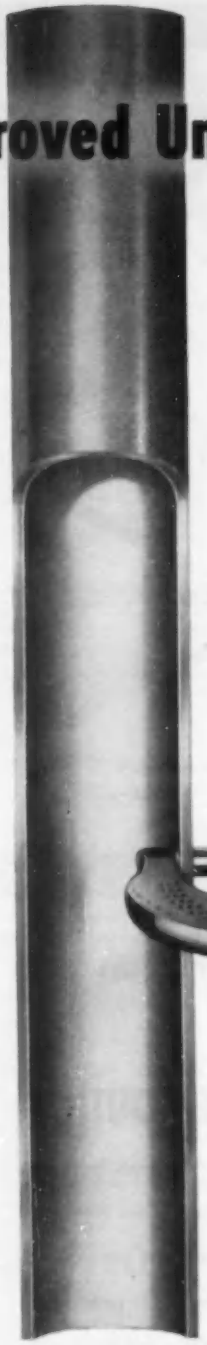


STANDARD CYLINDER TUBING

"Mirror Finished" to precision tolerances, it's used in automobile shock absorbers, power steering, hydraulic pumps . . . without further sizing or finishing.

Here's a busy part of an automobile shock absorber that's built for brutal punishment. It's Standard's modern "mirror-finish" Cylinder Tube. So that it won't weaken or leak under punishment, every inch of this tubular "toughie" must measure up to exacting specifications—in cylinder finish . . . in I.D. tolerances as close as .001″ . . . in extreme uniformity of wall thickness and concentricity . . . in internal pressure resistance, to shocks up to 9000 P.S.I. The elimination of broaching or further processing of any kind effect significant savings for our customers in product assembly.

As you see here, the engineering involved behind the application of tubing to your product is *more than skin deep at Standard.* Our engineers will gladly show you why in helping you with your tubular application—whether it involves a simple structural or mechanical member . . . or a precision application.

Send for 8-page folder on all Standard products or see Sweet's Design Catalog.

MAKE "STANDARD" YOUR SOURCE FOR—

- WELDED MECHANICAL TUBING
- WELDED STAINLESS TUBING
- BOILER AND HEAT EXCHANGER TUBING
- EXCLUSIVE "RIGIDIZED" PATTERNS

STEEL TUBING SIZES: ½″ O.D. TO 5½″ O.D.—.028 TO .260 WALL.
STAINLESS SIZES: ¼″ O.D. TO 4½″ O.D.—.020 TO .154 WALL.

CALENDAR

OF COMING SHOWS AND MEETINGS

Western Plant Maintenance and Engineering Show, Pan Pacific Auditorium, Los Angeles, Calif. July 12-14

TTMA Annual Summer Meeting, Sheraton - Cadillac Hotel, Detroit, Mich. ..... July 21-22

IAS Conference on Turbine Powered Air Transportation, Olympic Hotel, Seattle, Wash. ..... Aug. 8-10

SAE Golden Anniversary West Coast Meeting, Hotel Multnomah, Portland, Ore. ..... Aug. 15-17

NICB Symposium on Electronics and Automatic Production, San Francisco, Calif. ..... Aug. 22-23

Western Electronic Show and Convention, Civic Auditorium and Fairmont Hotel, San Francisco, Calif. ..... Aug. 24-26

General Motors Powerama, South Lake Shore Drive, Chicago, Ill. ..... Aug. 31-Sept. 25

National Aircraft Show, International Airport, Phila., Pa. Sept. 3-5

AMTDA Annual Meeting, Blackstone Hotel, Chicago, Ill. Sept. 5-6

Farnborough Air Show, England Sept. 5-11

Paris Automobile Show, France Sept. 6-16

NMTBA Machine Tool Show, International Amphitheater, Chicago, Ill. ..... Sept. 6-17

Production Engineering Show, Navy Pier, Chicago, Ill. ..... Sept. 6-17

Coliseum Machinery Show, Chicago, Ill. ..... Sept. 6-17

SAE Golden Anniversary Tractor Meeting and Production Forum, Hotel Schroeder, Milwaukee, Wis. ..... Sept. 12-15

Instrument Society of America, 10th annual Instrument-Automation Conference and Exhibit, Shrine Exposition Hall and Auditorium, Los Angeles, Calif. ..... Sept. 12-16

National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J. ..... Sept. 14-16

National Industrial Packaging and Materials Handling Show, Kingsbridge Armory, New York, N. Y. ..... Sept. 20-22

First Trade Fair of the Atomic Industry, Sheraton - Park Hotel, Washington, D. C. ..... Sept. 26-30

AIEE Fall General Meeting, Hotel Morrison, Chicago, Ill. ..... Oct. 3-7

World Plastics Fair and Trade Exposition, National Guard Armory, Los Angeles, Calif. . . Oct. 5-9

SAE Golden Anniversary Aeronautic Meeting, Production Forum, and Engineering Display, Hotel Statler, Los Angeles, Calif. Oct. 11-15

National Metal Exposition, Convention Hall, Philadelphia, Pa. . Oct. 17-21

International Motor Show, Earls Court, London, England . . . Oct. 19-29

Institute of Traffic Engineers, silver anniversary meeting, William Penn Hotel, Pittsburgh, Pa. Oct. 23-27

Canadian Industrial Tool and Equipment Show, Montreal, Canada ..... Oct. 24-28

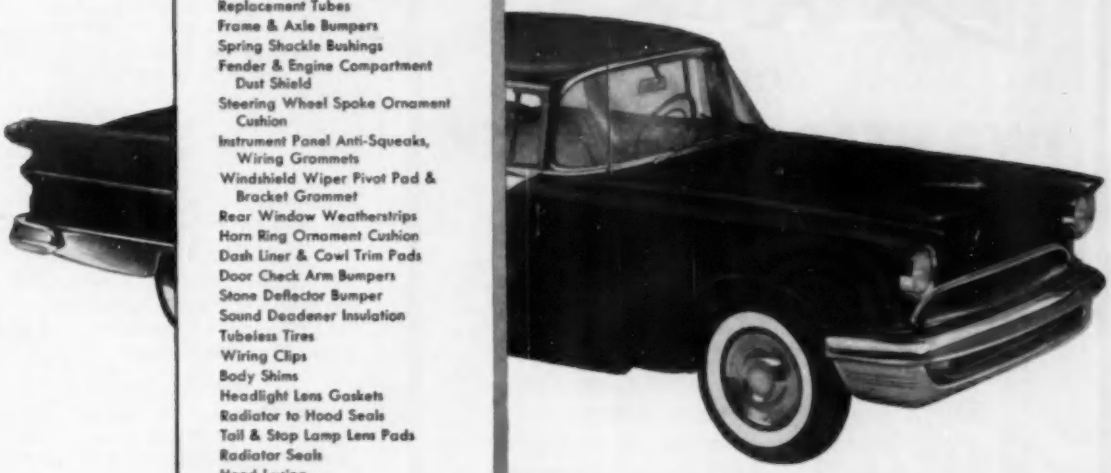
ASME-IME Joint Conference on Combustion, London, England Oct. 25-27

Automobile Old Timers, 16th anniversary dinner Waldorf - Astoria Hotel, New York, N. Y. . Oct. 28

SAE Golden Anniversary National Transportation Meeting, Hotel Chase, St. Louis, Mo. . . Oct. 31-Nov. 2

- Steering Collar Insulator
- Radiator Hose
- Heater Hose
- Body Insulators
- Heater Can Anti-Squeak Pad
- Steering Post Bracket Insulator
- Spark Plug Covers
- Steering Post Pads
- Radiator Drain Tube
- Silent Block Bushing
- Tail Pipe Insulator Support
- Wiper Hose
- Antenna Gaskets
- Division Channel Weatherstrip
- Window Channel Filler Seal
- Parking Light Lens Gaskets
- Bumper to Fender Spacer
- Fresh Air Adapter Grommets
- Battery Drain Tubes
- Gearshift Lever Arm Bushing
- Replacement Tubes
- Frame & Axle Bumpers
- Spring Shackle Bushings
- Fender & Engine Compartment Dust Shield
- Steering Wheel Spoke Ornament Cushion
- Instrument Panel Anti-Squeaks, Wiring Grommets
- Windshield Wiper Pivot Pad & Bracket Grommet
- Rear Window Weatherstrips
- Horn Ring Ornament Cushion
- Dash Liner & Cowl Trim Pads
- Door Check Arm Bumpers
- Stone Deflector Bumper
- Sound Deadener Insulation
- Tubeless Tires
- Wiring Clips
- Body Shims
- Headlight Lens Gaskets
- Radiator to Hood Seals
- Tail & Stop Lamp Lens Pads
- Radiator Seals
- Hood Lacing
- Fender Seals
- Hood Bumpers
- Bumper Grommet
- Glove Box Door Bumpers
- Gas Tank Filler Neck Grommet
- Sill Mats & Attaching Grommets
- Defroster Hose
- Door Bumpers

over 100 parts made from Enjay Butyl now used in '55 models



This car, like many other 1955 models, is setting new standards of performance and appearance. It is protected in vital places by parts made from Enjay Butyl—the super-durable rubber that outperforms and outlasts other types of rubber used in similar applications.

Enjay Butyl is amazingly resistant to weather, wear, and deterioration. It does not crack, chip, or lose its resiliency even under extreme conditions of use and climate. Butyl parts *stay* like *new*.

Butyl was developed exclusively by affiliates of the Enjay Company, Inc., and is now available in *new* non-staining grades for white and light-colored automotive parts. For full information and for technical assistance in the uses of Enjay Butyl, contact the

Enjay Company, Inc., 15 W. 51st St., New York 19, N. Y.
District Office: 11 South Portage Path, Akron 3, Ohio.

ENJAY BUTYL

OFTEN

TWO HEADS ARE BETTER THAN ONE

Sometimes two heads are the only solution to a part or fastener problem. Take a quick look at the belt buckle roller illustrated. This was a really special job and it solved a special problem for both the Armed Services and their suppliers. The k y problem here was to produce this roller in *quantity, inexpensively* and *quickly* . . . and HASSALL double-heading did the trick.

Double-heading is only one example of the almost limitless possibilities Hassall cold-heading offers you. If you have a fastener problem just send us samples or specifications for a quotation.

WRITE FOR CATALOG . . . with it we will send our popular decimal equivalent wall chart.
John Hassall, Inc., Box 2194, Westbury, L. I., N. Y.

HASSALL

SINCE 1850

H Hassall

NAILS, RIVETS, SCREWS
AND OTHER COLD-HEADED
FASTENERS AND SPECIALTIES

SHORTIES

There are at present approximately 1.4 million gasoline dispensing units of varying ages in the nation's 400,000 primary and secondary service stations.

•

Two alternators (ac generators) working as a single unit aboard each B-47 bomber produce enough electrical power to operate 55 ¾-ton room air conditioners, or enough to supply all the power needs of 20 average U. S. homes.

•

The average U. S. service station is open 100 hours a week. The most gasoline is sold between four and seven p.m.

•

It would take 500 automobile engines of 150 hp each to match the maximum power output of a single Stratojet bomber.

•

Total Government debt in 1954 was equal to 98 per cent of the country's national income. The Federal debt alone amounted to 87 per cent of the national income for the entire U. S.

•

Thirty per cent of all tax revenue collected by state governments in 1954, other than unemployment compensation, was obtained from special state automotive taxes. State taxes on gasoline alone accounted for one dollar out of every five taken in by the states.

•

Taxes on gasoline and automotive products accounted for more than 80 per cent of the money collected from manufacturers' excise taxes levied by the Federal Government in fiscal 1954. The Federal taxes on gasoline and lubricating oils brought in $904 million. Other Federal automotive taxes came to $1.305 billion.

•

A modern jet bomber contains a thousand or more gears.

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Company does not manufacture these garages. We supply only the Geon paste resin.

Low-cost housing project for America's cars

THIS easy-to-install garage covers your car end to end, from top to ground, and by protecting the finish against sunlight, dew, or salt air preserves the value of the car. The manufacturer has built years of service into this product by using steel tube construction and the rugged qualities of nylon fabric coated with a durable Geon based plastisol.

The Geon coated fabric has high tensile strength, yet is light in weight —same type material used by the U. S. Army for ponchos and arctic tent shelters. It fights off sunlight, is unaffected by salt and sand, will not crack, and remains pliable even in cold weather.

Other new and profitable uses for Geon polyvinyl materials are within the whole range of American industry. You'll find Geon in soft sponge, noncorrosive rigid piping, greaseproof paper coatings, moisture-proof insulation for wire, and in hundreds of other products. Your own business may base its next sales success on the remarkable properties of Geon. For more information, please write Dept. BA-4, B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more salcable.

GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

Air Force Specifications Clarified at Diesel Conference

(*Continued from page* 51)

The determination of whether a stationary power plant shall be Diesel or steam-turbine powered is based on the following criteria:

(a) When the electrical generating plant and central heating plant can be combined, steam-turbine-driven generators, with steam extraction for heat are anticipated to be used.

(b) For demand leads of 10,000 kw or less Diesel-engine generators will be used.

(c) For demands larger than 10,000 kw, steam-turbine or Diesel-driven generators may be used. The type of prime mover will be selected on the basis of the most economical installation.

Stationary Diesel-electric power plants used by the Air Force generally range from 100 to 2500 kw in size; however, a few of them are smaller than 100 kw. Nominal system voltages produced by the larger plants either 2400/4160 or 7200/12460 (3 phase-4 wire).

The next largest requirement for Diesel engines in the Air Force is as prime movers for construction equipment used to equip airfield construction troops and airbase maintenance forces. Each battalion is equipped with approximately 4¼ million dollars worth of construction equipment, most of which is powered by Diesel engines.

Similar, but usually smaller construction equipment is used by Installations Squadrons which comprise our airbase maintenance force. The Air Force maintains several hundred active installations.

Thus, the total Air Force requirement for Diesel engines for construction equipment is quite large.

A limited requirement exists for Diesel engines for switching locomotives used on airbases, aircraft rescue boats and, to an increasing degree, for aircraft towing tractors.

The foregoing gives an indication of Air Force general applications of, and quantitative requirements for, Diesel engines. Now, let us look at some special applications.

For ground support of aircraft, 28.5-volt d-c high-amperage current is required for starting and servicing. In addition, 400-cycle, single- and 3-phase, closely regulated current is required for servicing aircraft components and for check-out of navigation and fire-control systems.

A version of this type electrical support of aircraft uses a 150-kw Diesel-electric generator generating 254/440-volt, 60-cycle, 3-phase current, with motor generator and rectifier conversion equipment, interconnected through a distribution cabinet. The Diesel engine has imposed on it a critical isochronous governing requirement for 60-cycle current plus or minus 1 per cent no-to-full load with steady-state values in the order of plus or minus 0.25 per cent. This governing requirement is imposed due to the synchronous motor-driven generator sets remotely driven in support of precise navigation and fire-control systems. The engines are in the 225-hp continuously rated class.

Besides the heavy shock loads that can approximate 200 per cent overload on the engine, there is another

Expertly machined
HARDENED & GROUND PARTS

THE sleeve shown here is a large piece and represents an exacting job—the kind we handle well. It calls for accurately hobbed threads over the full length . . . a polish-ground bore concentric with the pitch diameter of the threads . . . tolerances that challenge our ingenuity and skill.

Brown Hardened and Ground Parts have served the automotive industry for more than 40 years. In that time we've gained invaluable experience in precision machining, scientifically-controlled heat treating and micro-finish grinding. These capable facilities are at your command. Merely send us your prints; write or wire your requirements.

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PRESIDENT

Experienced production on . . .
King Pins • Shackle Bolts • Shackle Pins
Brake Anchor Bolts • Countershafts
Idler Shafts • Stub Axle Shafts
Steering Ball Bolts
Beam Bolts and Bolts
5th Wheel Rocker Shafts • Wheel Studs
Water Pump Shafts
. . . anything in the hardened and ground line, of any analysis steel, up to 4¼" diameter.

THE BROWN CORP.
213 BELLEVUE AVE. SYRACUSE, N. Y.
C. H. Elliott, 3407 Clarendon Rd., Cleveland • N. F. Spring, 6715 Balfour Rd., Detroit • R. C. Stockwell, 5631 N. Ashland Ave., Chicago • Harry J. Windenitor, 1704 Carlton, Fort Worth • Lyle H. Johnson, 1350 Westwood Blvd., Los Angeles, Calif. • John B. Hunt, 5611 S.E. Vandolt St., Portland, Ore.

stringent requirement placed upon Diesel engines in this application. This is long-time, very light or no load operation at high governed synchronous speed. This application, in addition to using the engine at a point of inefficient combustion, causes premature oil contamination, heavy carbon deposition, more frequent injector maintenance, more frequent oil and oil-filter changes and increased general over-all maintenance. After a prolonged period of very light loads when shock loaded due to multiple jet-engine starts, heavy and excessive sparking can occur. Owing to the proximity to aircraft, this sparking can be a fire hazard.

Wright Air Development Center is investigating this problem to determine possible remedies. Presently spark arresters are used to reduce the hazard. When these are used, the exhaust system, including muffler and spark arrester, should not produce a back pressure greater than 4 in. of mercury at any load up to the rated net continuous load for the engine.

General radar, communications, and electronic electrical support, where portable power plants are called for, is met by Diesel-engine-driven 60-cycle generator sets. Most of the conversion to 24 volt d-c and 400-cycle power required is done with rectifiers and motor-generator sets.

The 60-cycle generator sets are 15 kw, 30 kw, 60 kw, 100 kw, and 150 kw portable skid-mounted units purchased to Military Specification MIL-G-10327A (CE). To meet portability requirements the maximum dry weight allowable is 3100, 4800, 5950, 10,700 and 13,650 lb respectively. When equipped with all accessories, they must be capable of maintaining rated output for 1500 hr, and be capable of starting promptly, and of operating at any continuous load up to full rating, under any of the following conditions: (a) 5000 ft elevation at an ambient temperature of 107 F; (b) 85 per cent relative humidity at an ambient temperature of 85 F; (c) at any ambient temperature from 125 F to minus 25 without use of external heat; (d) with the base of the generator set inclined in any plant at any angle from level to 15 deg from level. The generator sets must be free of injurious flexural vibrations and dangerous torsional critical speeds between 20 per cent below the lowest operating speed and 20 per cent above the highest operating speed. Dangerous torsional critical speed is defined as the speed at which the maximum vibrating stress in the

3 JOHN CRANE "Pressed-In" SEALS

for economy, quick installation and life-long performance in all types of service

TYPE 11-A

Synthetic Rubber Bellows • Small shafts to ¾ in.

Services: hot or cold water, oil, gasoline, kerosene and other liquids non-injurious to synthetic rubber.

Pressures: up to 50 psi.

Temperatures: −65°F. to +220°F.

Construction Data: Packaged unit. Retainer does not contact shaft, permitting operation at a high rpm. One size can be used for several shaft sizes. Bellows encloses spring and metal parts to prevent contact with medium being sealed.

TYPE 6-A

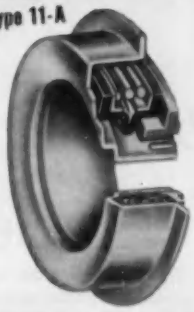
Synthetic Rubber Bellows • Interchangeable with Type 11-A

Services: hot or cold water, oil, gasoline, soapy and other liquids non-injurious to synthetic rubber.

Pressures: up to 75 psi.

Temperatures: −65°F. to +220°F.

Construction Data: Similar to Type 11-A. Does not contact shaft, permitting operation at high rpm. One size can be used for several shaft sizes. Spring and metal parts available in stainless steel or bronze.



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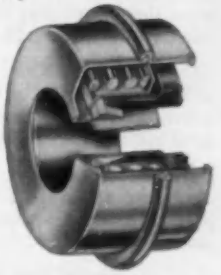
Sealing Members Made of Teflon* • Engineered for the particular application

Services: all chemicals, solvents, oils, corrosives and gases, hot or cold.

Pressures: up to 150 psi.

Temperatures: −120°F. to +500°F.

Construction Data: Packaged unit. Furnished in metallurgical specification best suited to the application. Chemically-inert Teflon wedge ring closely fits inner sleeve of retainer and is machine-mated to carbon sealing washer.



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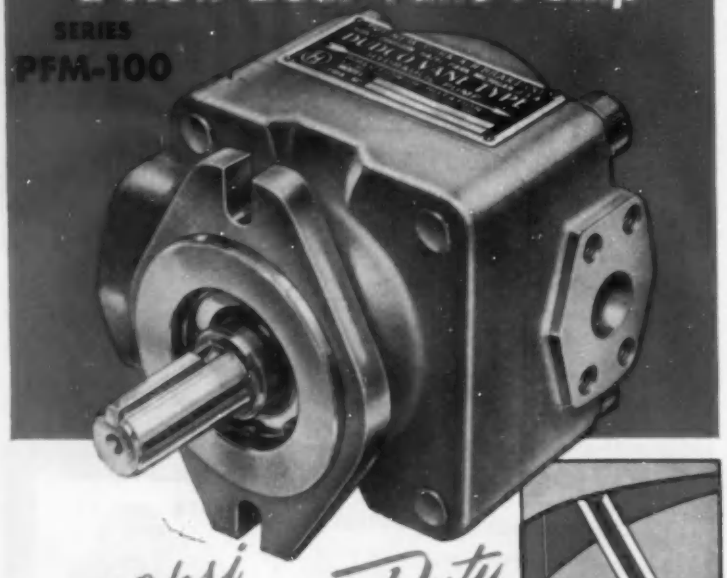
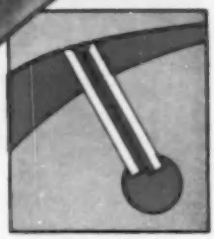
for MOBILE EQUIPMENT
a New Dual-Vane Pump

SERIES
PFM-100



2000 psi Continuous Duty
3 to 11 gpm at 1200 rpm 0 psi



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The hydraulically counterbalanced DUAL-VANES in DUDCO Hydraulic Pumps eliminate wear producing loads normally caused by unbalanced hydraulic forces and vane acceleration. DUAL-VANES also maintain MULTIPLE SEALING BARRIERS to slippage and power loss. DUAL-VANES are a patented and exclusive DUDCO feature.

This Pump was engineered to meet the special conditions characteristic of service on mobile equipment.

Here is a pump designed for high speed direct engine drive that can be operated *continuously* at *2000* psi and *2000* rpm to meet the continuing demand for more work from your equipment.

The exclusive DUDCO Dual-Vane design provides and assures *complete hydraulic balance* of all internal parts. Bearing loads and cam ring wear are reduced so DUDCO PFM-100 Pumps last longer.

Designing these Pumps into your machines is made easier because all standard S.A.E. or industrial mountings and piping provisions are available, as well as complete flexibility of port positions.

PFM-100 Series Pumps are priced for the competitive mobile equipment market . . . NO price penalty for high pressure equipment.

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THE NEW YORK AIR BRAKE COMPANY
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shaft from torsional vibration induced in the shaft exceeds 5000 psi.

Since the Air Force uses Diesel engines world-wide, the supply of adequate fuel of the proper type presents quite a problem. The only recommended Diesel fuel at present is that described in Specification MIL-F-896. Under this specification there are three types of Diesel fuels, one of which is fluid down to —70 F. Owing to the supply problems mentioned, we are investigating the use of JP-4 jet fuels for Diesel engines. It is contemplated that JP-4 jet fuel will only be used in limited applications or in special geographic areas.

Induction Hardening

(*Continued from page* 50)

of all shafts is scanned by the coil and is heated to the quenching temperature. As the heated areas emerge from the coils, they are quenched immediately by the water sprays. This casehardens the shafts from end to end.

At the end of this stroke, current is shut off and the shafts are fed upward until the 3½-in. long taper to be tempered is partly inside and partly above the coils. Then current is turned on but only 20 kw are fed to each coil as the shafts feed down and tapers are tempered. Thereupon, current is shut off and shafts are rapidly elevated. When they come to rest, upper centers retract, shafts stop rotating (which has been continuous to this point) and are unloaded.

This entire cycle is automatic, except for loading, pressing the start button and unloading, and results in a total heat-treating time of only 17 sec per shaft. Two machines are designed to heat-treat 160 shafts an hour. With the rapid heating, almost no scale is produced and the shafts are ready for cutting the keyway and final grinding. Because the shafts are kept rotating and heat is applied uniformly on all sides, warpage is minimized but all shafts are checked for straightness and are straightened if required before grinding.

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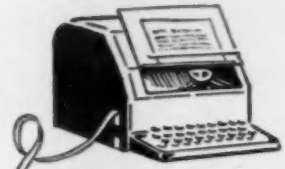

ON OUR WASHINGTON WIRE

Jurisdiction over the Government's $6 million worth of machine tools, Hoover Commission on Government Reorganization says, should be taken away from the General Services Administration and returned to the Defense Department to improve administration. Of the total, $3.9 billion worth are installed in Government or private plants on Government contracts, and the remainder are stored in private plants and warehouses.

Development of a practical atomic-powered airplane is now said to be a lot closer at hand. AEC is asking Congress for about $38 million to push the program.

Government buying of guided missiles will edge up during the next 12 months. It is to climb from a total of half a billion dollars to about two-thirds of a billion. Machine tool purchases are expected to total around $100 million.

The Administration's $101 billion highway construction is far from washed up, despite the beating administered it by Senate and House Democrats. Next year may see the biggest part of the program written into law.

Anti-trust laws in the automobile field are now reportedly being handled by two Federal agencies. FTC is said to be taking complaints involving automotive parts, while those involving automobiles themselves are being referred to the Justice Dept.

Government stockpile officials hope to fill six more minimum goals in the next 12 months. As of June 30, the Government had about 39 of its 75 goals accomplished, and nine others 75 per cent or more filled.

Arm-weary tractor operators are grateful for TD-14A and TD-18A International Harvester crawlers. They steer with the ease of a late model car for each track is controlled by its own hydraulic circuit...a booster system with velvet smooth, positive action that stems from

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Here is a HYDRECO dual pump that delivers 5 gpm to each circuit at 1200 rpm against a system pressure of 700 psi. The dual pump provides a circuit for each track and the result . . . no arm-weary operators . . . more accomplished with less effort, in less time . . . smoother, higher performance . . . lower maintenance.

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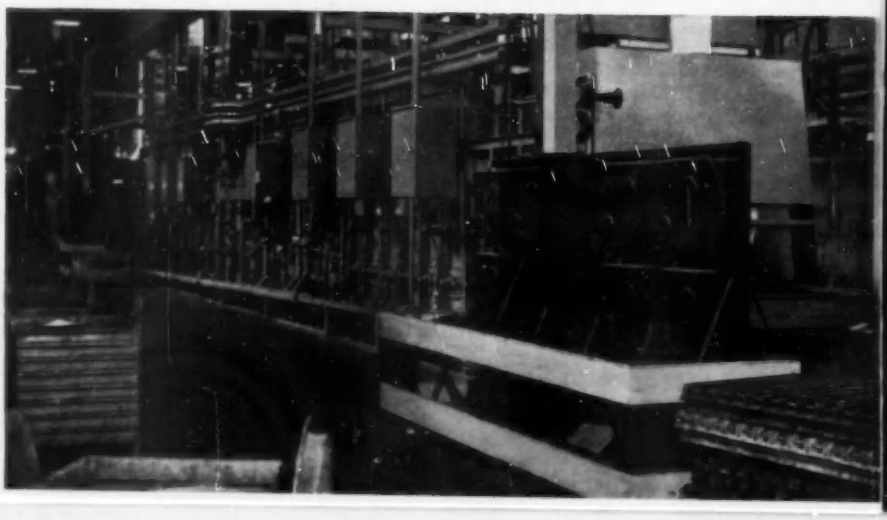
Caterpillar bulldozers speeded construction on the Banff Windermere Highway at Mount Eisenhower in Alberta, Canada.

One of six at Caterpillar, this Westinghouse cycle annealer treats metals in a controlled atmosphere to avoid scaling.



Westinghouse annealers at Caterpillar® improve machinability

To insure quality products at competitive prices, Caterpillar Tractor Company is quick to study and test any new idea that might lead to reduced production costs and improved product performance. For instance, isothermal annealing of forgings before machining promised such results.

Installation of two Westinghouse cycle annealing furnaces demonstrated their value. Now Caterpillar uses six Westinghouse furnaces—some electric, some gas fired. Westinghouse tailored them to fit Caterpillar's precise needs.

These furnaces have proved they can produce the kind of microstructure allowing the highest rate of machinability and the desired finish. Here's another example of how Westinghouse engineers, working closely with the customer, help turn out a finer product at less cost. A call to your nearby Westinghouse Sales Engineer, The Man With The Facts, may produce heat-treating ideas for you, too. J-10456

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SAE Summer Meeting

(*Continued from page 69*)

ever, widespread use of aluminum for these parts in the future is predicted.

A rather safe prediction is that aluminum radiator grilles will soon make their appearance on a number of cars, thereby introducing its use for exterior trim in the natural bright finish. A further prediction is that aluminum bumpers and hub caps will be the next bright finished aluminum items to appear, because aluminum is well suited for these parts, and they can be finished to match the grille.

To speed up the use of aluminum in radiators, development work is progressing on a hybrid type, having brass coolant passages and aluminum fins. This combination of material will permit soldering with zinc-tin solder in the existing furnaces with only minor changes in temperature and time settings. With this type of radiator, external corrosion could pose somewhat of a problem. However, this problem can be solved by using commercial protective coatings on the outside of the finished core.

The next most promising future aluminum use, which depends on its ready availability, is for electrical conductors—particularly for the field coils and armature windings used in electric motors, generators, and starters. Battery cables, ground straps and wiring harness also should be included in this group.

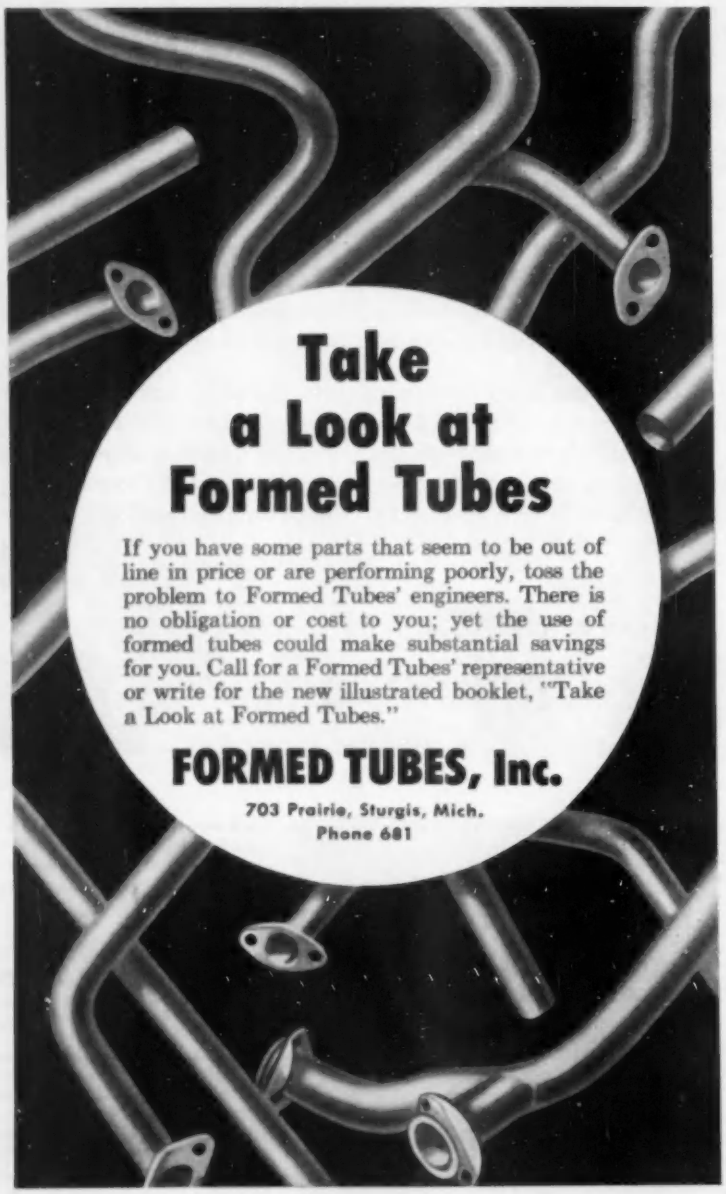
Outstanding examples of parts made at a lower finished part cost are the headlamp retaining ring and sockets. Others are valve assemblies, stators and impellers, and extensions for automatic transmissions, flywheel housings, and screw machine products.

The savings in the aluminum valve bodies and covers are made chiefly by the amount of reduced cleaning and machining time. These parts have many deep, intricate passages and ports directing the flow of oil, and when they are made of aluminum, much less labor is required for inspecting, removing obstructions and smoothing rough areas. Also the actual machining time is considerably lower for the aluminum die castings than for iron castings.

Screw machine parts made of aluminum show appreciable cost savings over duplicate parts made from the common copper-base alloys and stainless steels. The great difference in material cost for an equal number of parts is responsible for the major savings, but additional savings are possible because of higher permissible cutting speeds and increased tool life. In many cases it is possible to use machine finished parts without additional buffing or plating to replace plated brass parts.

Another good example of multiple gains is the radiator core. For this application, aluminum is being considered primarily because of assured future supply at a stable price, but the manufacturers will also benefit by the reduction in cost which may amount to approximately $4 per unit. The owner will receive all the benefits made possible by a weight reduction of about 13 lb.

The die casting process does not limit the designer to an abnormally thick metal section as a minimum, but permits him to specify the correct wall thickness needed to carry the load. For example, it is not necessary to add another 1/16 in. or more to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wall thickness merely to allow for possible core-shift or to insure complete filling of the mold cavity.

A die casting machine capable of producing castings weighing up to approximately 75 lb is already in operation and will soon be used for producing experimental six cylinder engine block castings.

Radioactivity and Automotive Measurements

By A. M. Smith
Research Department
Engineering Staff
Ford Motor Co.

RADIOISOTOPE applications can be divided into two classes. In one, radiation is used to accomplish some useful process. Radiography, the process of photographing the internal structure of an object, is a typical example of the usefulness of radiation. Gas ionization, the pasturization of foods and drugs, and radiation effects on chemical processes are other radiation applications.

The other class of radioisotope applications involve the tagging of systems which require study. Radiation measurements can then be made to determine the operation of the system. Mechanical parts can be tagged and then located by radiation measurements when visual observation is not possible. Other systems can be tagged to permit the tracing of minute quantities of material. The tracking of a particular chemical element through complex chemical processes also is possible.

We have used radioactive materials for applications which fall into several of these categories. It is often possible to use radioisotopes for a single problem without large expenditures for facilities or personnel. The radiological hazards are usually easy to control with proper procedures and the special techniques required are often quite simple.

A useful application of radioisotopes to automotive measurements is the measurement of the rotation of piston rings around the piston during engine operation. Only a small quantity of radioactivity is required and relatively crude instrumentation is adequate. A small piece of radioactive cobalt wire is installed in a piston ring cavity. A brass plug retains the cobalt fragment. All radio-

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activity is kept within this chamber so the test can be run in a dynamometer cell without fear of contaminating the area. Two Geiger counters, 90 deg apart would each respond when the ring gap approached within 45 deg. When the information from both Geiger counters is used, it has been possible to locate the approximate position of the ring gap anywhere within 180 deg. During test periods, when the piston ring was rotating at a relatively uniform rate, this information was adequate.

The precise measurement of air flow in mobile testing has been accomplished using radioactive techniques. Alpha rays form a high ion concentration in a limited region of an air flow path. A combination of the transverse motion induced by the applied electric potential and the longitudinal motion of the air stream carries some of the ions to the collector electrode. The number of ions collected is approximately a linear function of the quantity of air flowing through the instrument.

Another problem which has received some attention is the measurement of head gasket coolant leaks. To accomplish this measurement, Yttrium 90, a short lived radioisotope, is dissolved in the coolant. The radioactive Yttrium is deposited along the leakage path and wherever the coolant evaporates to dryness. The leakage pattern is then detected by exposing an X-ray film in contact with the demounted gasket.

Mixing problems are especially suited to solution using radioactivity. Tractors may leak hydraulic system oil into the crank case, transmission or rear axle. Engineers wanted to know the amount of mixing of the oils. A small quantity of radioactive iron was dissolved in the oil of one chamber. The tractor was operated for 100 hours and samples of the clean chambers were analyzed for radioactive content. Using this procedure, a leakage of a few milliliters could easily be measured.

Some work has been done with filter efficiency measurements. Although increased precision of measurement appeared possible, the processes tried for isotope measurement could not compete in simplicity.

The metal thickness between a drilled hole and the outside of a casting was measured. The operation of a sinter plant for clinkering iron oxide powders was studied using tracers. The direct measurement of oil consumption of automotive engines during tests is under investigation.

(*Turn to page* 119, *please*)

SAE Summer Meeting

(*Continued from page* 118)

Experimental Testing of New Friction Materials for Automatic Transmissions

By H. W. Schultz
Moraine Products Div.
General Motors Corp.

DATA obtained from experimental testing of friction materials operating in oil have long been a subject of controversy between transmission engineers. Due to more rigid and varied customer demands, we have felt that present types of test units are somewhat inadequate to furnish the overall desired information covering all types of friction materials. It was felt that a test unit should be constructed which would simulate, as closely as possible, actual engine-transmission and vehicle testing. This would use a single test plate with a simple hydraulic actuating system so that most variables might be reduced to a minimum. It is also our opinion that the finest instrumentation available should be incorporated. Accordingly, such a dynamometer is being completed.

By selective electrical and mechanical control, we are able to drive at any desired speed, both the drive and driven members of the test unit. Both of these operate completely independent of each other and at any desired and closely controlled speed. This range can vary from several rpm to 3500 rpm on either or both plates.

The flywheels, adjusted to any desired inertia load are also used on both drive and driven members. Either can be instantly connected or disconnected by means of specially designed disconnect clutches.

The test clutch assembly can be actuated by controlled hydraulic apply pressure, simulating closely that present in the actual transmission operation. Electronic instrumentation is used throughout, with the exception of time clocks, pressure gages, etc., which are used for visual information. A multichannel recording oscillograph together with associate sensing units, amplifiers, thermocouples and other associate equipment, present a fast, concise picture of the entire operational cycle regardless of duration. Any physical phenomena convertible into an electrical signal may be read and interpreted. Regarding recording, 100 in. of recorded data may be obtained in one second of operation. With this instrumentation we can record simultaneously as many as 14 separate items of data during a desired time interval.

Further, this test unit may be instantly converted into a constant drive unit, locking the driven member in order to study constant slip applications under all conditions of speed and pressure and recording the desired data as previously outlined.

The test machine is also designed to be instantly changed to a conventional inertia dynamometer by operating the prime mover, inertia flywheel, (which is variable) and disconnect clutch as desired. This in a manner simulates the inertia dyna-

(*Turn to page* 122, *please*)

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- Simplifies installation and maintenance of dopers, cushions, lifters, Iron Hands and other work-handling devices.
- Leaves clean, uncluttered exterior—cranes can move up close to load or unload dies without bumping or snagging.

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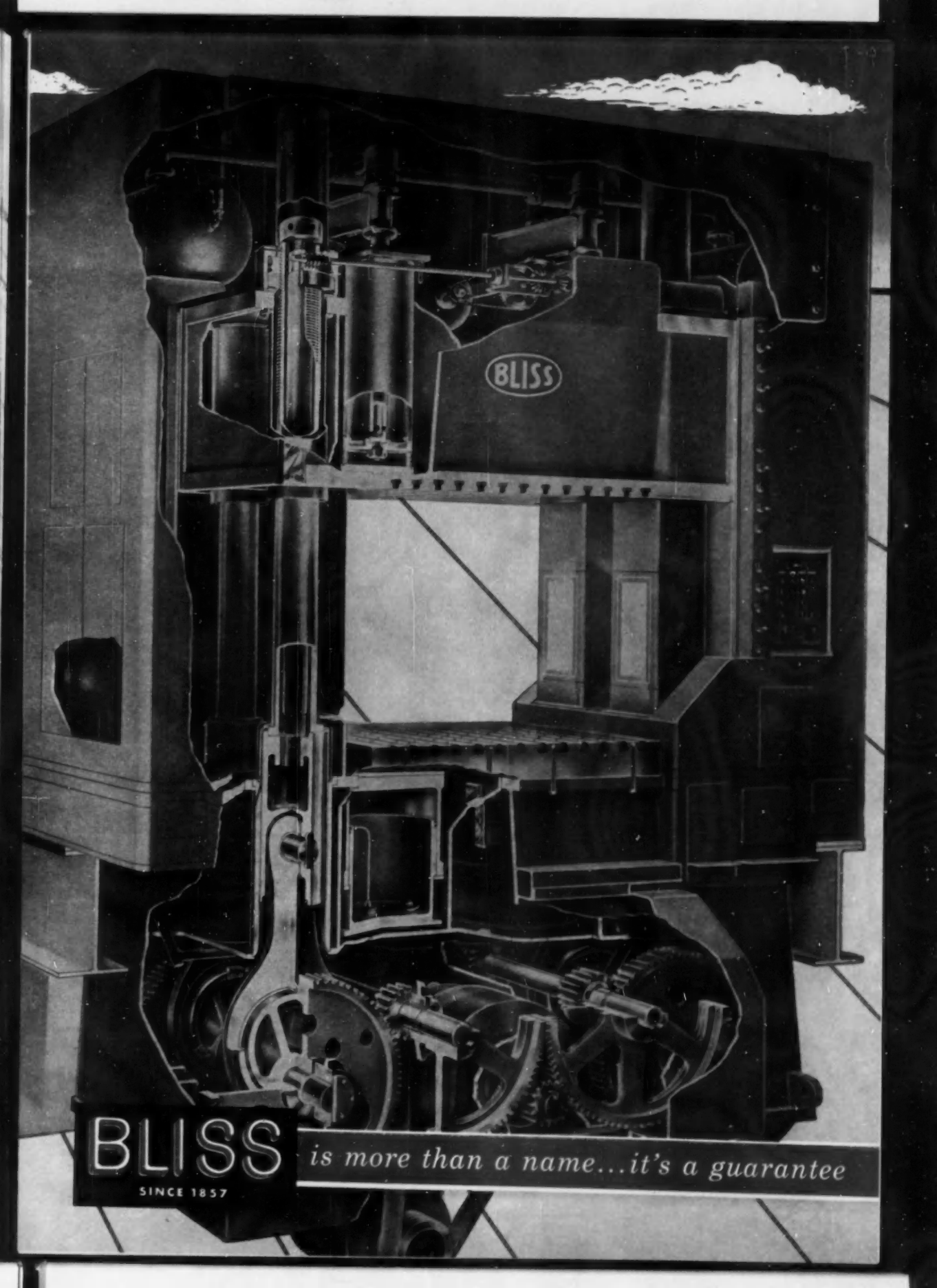
- Integral gear and eccentric drive—its compactness allows gears to operate within the crown. No overhanging gear guards. And Bliss' design eliminates torsional deflection of main pin, minimizes distortions due to overloads.
- New automatic lubricating system—a recirculating type which has proved foolproof in service. Positive piston displacement method automatically lubricates every bearing surface at predetermined intervals. Electrical interlocks shut down press if a single feeder fails.
- Cool-running high speed clutch—Bliss' combination pneumatic friction clutch and brake is extremely fast—only a fraction of an inch needed between full engagement and brake. Self-aligning feature automatically compensates for wear. Clutch is also self-cooling.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Photos and data courtesy of Delco Industries, Inc., Rochester, N. Y.

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with EASY-FLO 45, to make an oil and air-tight braze of a threaded spud into the cover of the pressure switch which is part of the Studebaker anti-creep "hill holding" device. Operator merely sets covers on holders on an endless chain, and places in each cover a spud with a ring of EASY-FLO 45 preplaced. Assemblies pass through an induction heating coil 14 a minute.

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There's no "...or equal" for EASY-FLO and SIL-FOS

(*Continued from page* 119)

mometers generally in use today for this type of testing. Here, again, we can operate from any given speed, at any desired pressure or temperature, also recording most any other data desired. This particular arrangement also permits excellent facilities for evaluation of various oils and groove patterns.

It should be definitely understood that while this particular test machine can duplicate most any desired condition of operation, it cannot appraise the actual transmission "feel." Therefore, it is chiefly a yardstick for evaluation of performance and does not eliminate engine dynamometer testing of the complete clutch pack or does it elminate vehicle testing for actual transmission performance. It will, however, substantially reduce much of this work by accurate pre-evaluation of an unknown material.

Instrumentation for Valve Burning Studies

By W. D. Sims
Shell Oil Co.

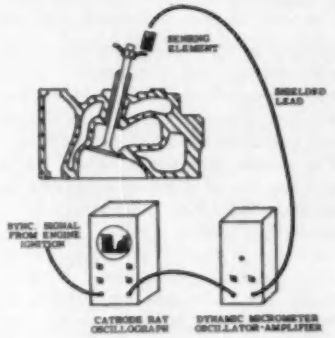
REALISTIC valve life in terms of road operation was achieved in a laboratory cyclic test designed to simulate the power demands of highway driving as recorded during a passenger car road test in which valve burning was experienced. Valve burning was evident after 250 hours at the simulated highway test conditions. This was in excellent agreement with the 15,000-mile (300-hour) valve life in this engine during the actual road test.

In view of the shortcomings of previously employed methods it was necessary to consider a new approach. Emphasis was placed on selecting a system which would not influence valve motion and would permit the use of standard engine parts. It was necessary that the apparatus be rugged and easy to operate, applicable to the simulated highway test procedure, and provide magnification of the portions of valve travel very near the closed position. Finally, it was desirable to use available equipment if possible.

The Dynamic Micrometer made by Electro Products was selected. This electronic device was designed for observation of shaft runout, turbine-wheel growth or vibration in turbine-type equipment. It consists of an electrical reluctance pickup or sensing unit mounted in a screw micrometer. It is supplied with a known signal from an oscillator circuit fur-

nished with the assembly. The output signal, which is varied by proximity of magnetic metal to the pickup, is observed on the screen of a cathode-ray oscillograph.

The pickup is mounted on a bar fastened along the cylinder head. The

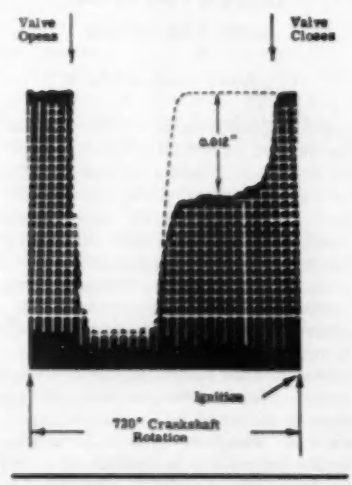


Schematic layout of Dynamic Micrometer

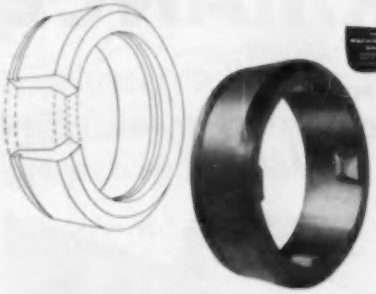
support is machined to maintain the axis of the pickup parallel to that of the exhaust valve stems. Six stations are established to allow location of the pickup adjacent to each exhaust valve. The metal face registering with the active end of the pickup is the valve spring washer. Height of the pattern on the oscillograph changes with the clearance between the washer and the pickup as shown in the calibration curve. Since the sweep of the oscillograph is synchronized by the ignition of the engine, motion can be related to crank angle.

The technique employed consists of observing the motion of all exhaust valves at 8- to 24-hour intervals. The engine is operated at simulated highway test conditions during observation. At each station the pickup and micrometer assembly is bolted to the mounting bar and the micrometer screw turned down to obtain a maximum pattern height of three in. The oscillograph gain is preset so as to indicate this pattern height at a clearance of 0.005 in. Motion of the valve can then be related to the calibration curve for determination of axial displacements.

Reference to the calibration curve shows that the instrument is most sensitive with small clearance between pickup and object. While this characteristic is highly desirable in permitting observation of movements as small as 0.0005 in., it requires extreme rigidity in the mounting. It also was found that a smooth surface finish is necessary on the valve spring washer in order to obtain repro-

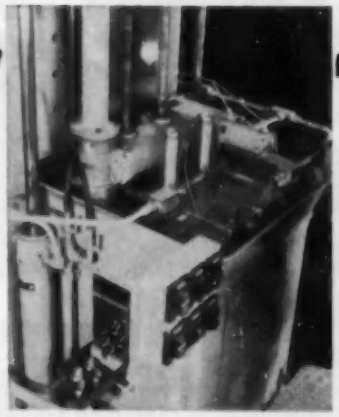


Oscillograph trace showing exhaust valve sticking 0.012 in. from seat until compression stroke (dashed line shows normal closing)



I. D. and four inverted helical splines BROACHED the American way

...300 parts per hour



American engineering made this broaching operation fast, automatic and economical.

The finished inside diameter and four inverted helical splines are broached, in this automotive synchronizer ring, two at a time . . . 300 per hour.

American special combination round and spiral spline broaches are used to cut the splines concentric with the I.D.

Feed tubes are here shown as manually loaded but are readily adapted to automation. Parts are fed and ejected by automatic hydraulic slides.

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ducible pattern height vs clearance relationship. In addition to observation of valve motion, any dimensional changes due to seat deposit accumulation or valve stretch can be followed.

The mechanism of exhaust valve burning in passenger car engines appears as interpreted with the aid of the Dynamic Micrometer to be principally one of valve face corrosion. It is known that most combustion chamber deposits become markedly corrosive to metals at temperatures approaching their melting point. Under normal operating conditions with properly seating valves, valve face temperatures are sufficiently below the melting points of the deposits and corrosion proceeds slowly. When dynamic sticking occurs the cooling of the valve by seat contact is affected and valve temperature increases, highly accelerating corrosion of the valve face.

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Easy Starting! Perfect Idling! Economy!

AUTOMATION NEWS REPORT

(*Continued from page* 71)

VENDOR RATING

At the Ninth Annual Convention of the American Society for Quality Control in New York last month, an electronic system for vendor rating was domonstrated by International Business Machine Corp., using a type 604 calculator and 407 page printer. The system involves a special form and the use of a set of equations to evaluate the vendor's departure from established quality levels. IBM demonstrated a quality analysis system using similar equipment. Bendix-Radio Div. also had an exhibit of vendor rating methods using its equipment.

Automatic Rockwell hardness testing was demonstrated by Wilson Mechanical Instrument Div. The tester performs the ASTM test on small parts at 1000 per hour, segregating the work into soft, correct, and hard categories by means of adjustable photoelectric diodes around the dial. The diodes can be set to a fineness of two points for passable workpieces. Parts are fed by a vibratory hopper.

Sperry Products, Inc., exhibited its latest Reflectoscope ultrasonic testing equipment, using a motion picture to explain basic principles of the method.

OBSERVATIONS
at the SAE *Meeting*

(*Continued from page* 92)

tended exclusively for large volume production, particularly where the life of the product design is long enough to amortize them. Small lot production can seldom justify such equipment. On the other hand, all of the tricks of current vintage—conveyors, mechanical handling arrangements, production aids, etc.—can be employed to advantage on any kind of operation. Moreover, most manufacturers who use single-purpose or automatic cycle machines can take advantage of the trend by the simple expedient of installing suitable arrangements for automatic loading and unloading, thus making it possible to take full advantage of the inherent productivity of such machines.

(*Turn to page* 125, *please*)

OBSERVATIONS

at the **SAE** *Meeting*

(*Continued from page* 124)

Cooling Fans

A large group of parts makers who have been marketing various types of devices for controlling fan operation —free-wheeling the fan when cooling is not needed—would have enjoyed the session on cooling. Eventually discussion led to fan operation. Passenger car fans, according to current studies, take from eight to 12 horsepower, heavy-duty engines require around 22 to 30 horsepower for fan drives. There is an obvious need for some suitable clutch device to cut out the fan at the proper time and thus conserve engine power. Perhaps this is a good time to accelerate thinking on this subject.

Automatic Transmissions

For years the automatic drive for passenger cars has held the center of the stage. Today there is an unquestioned need for heavy-duty automatic drives for trucks of all sizes. In fact, there is a lot of activity in the background and it should emerge before long.

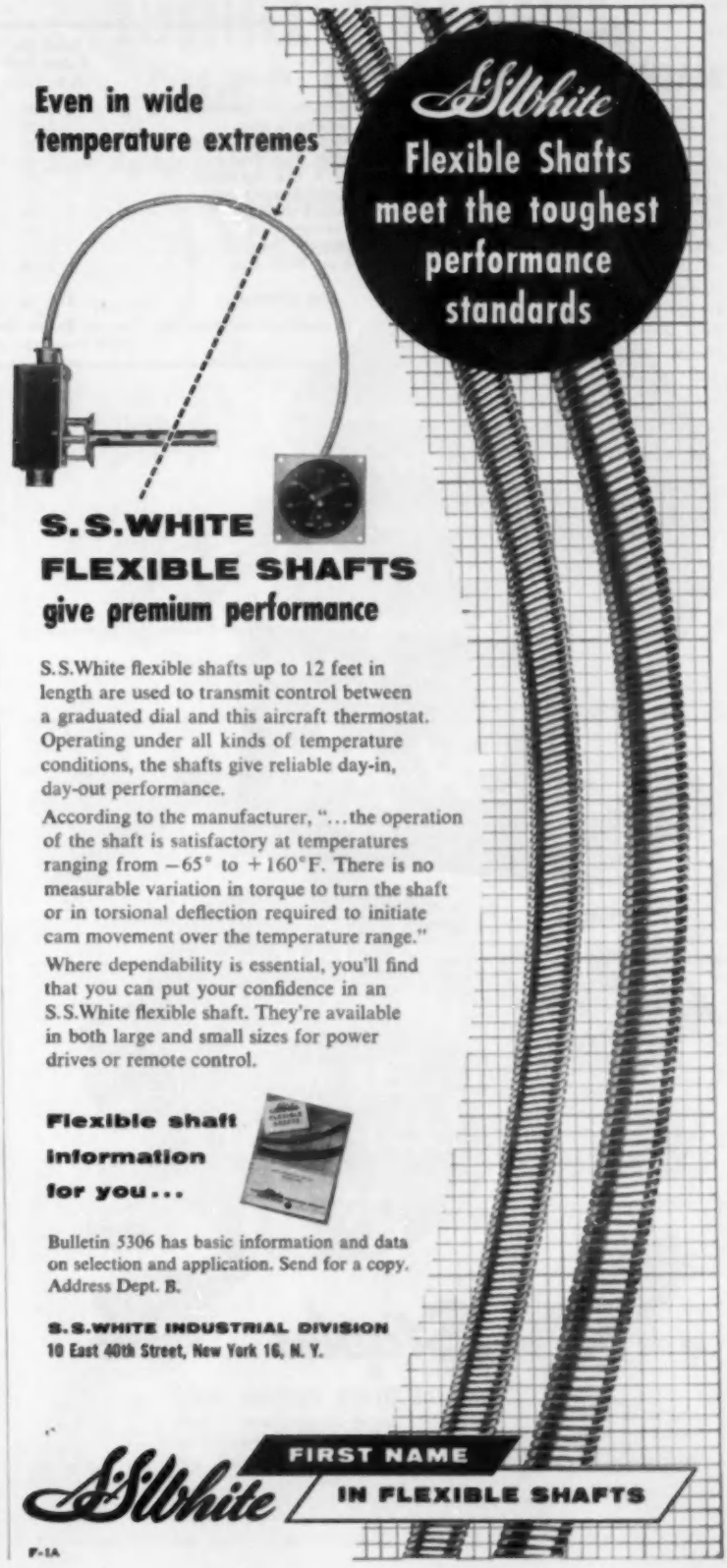
Le Mans Race

(*Continued from page* 102)

can be taken on only at intervals of 268 miles.

Piston displacement varied from the 276 cu in. of the six-cylinder French Talbot to the 45 cu in. of such Italian and French cars as Nardi, D. B., Moretti and Renault-engined vehicles. A formula based on distance covered in relation to piston displacement attempts to put all cars on an equality. Up to the present this formula has favored small cars, but this year's changes make it possible for a car to win on distance and on formula.

Outstanding features of this year's cars were refinements in head resistance, decreased weight, and brake refinements. Last year it was thought that a closed car offered advantages in head resistance, but since then the change has been complete, not a single closed car being brought to the starting line. It was particularly in small piston displacements that most of the work had been done in reducing head resistance.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S.S.White flexible shafts up to 12 feet in length are used to transmit control between a graduated dial and this aircraft thermostat. Operating under all kinds of temperature conditions, the shafts give reliable day-in, day-out performance.
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News of the MACHINERY INDUSTRIES

(*Continued from page 79*)

The Timken Roller Bearing Co., now has available graphitic hollow-bar tool steel for making dies and gages. The product is rough turned on the OD and bored on the ID; it is available in lengths ranging from six to 10 ft. Economies resulting in the use of the material by Timken are shown in the accompanying Table.

Product	Solid Bar Labor Cost (Ave. 1 pc.)	Hollow Bar Tool Steel Labor Cost (Ave. 1 pc.)	Savings	Per Cent Savings
ID Size & Taper Master	$ 1.90	$ 1.40	$ .50	26
Closing-in Die	3.72	2.43	1.29	35
Mult. Wing & Spread Die	2.63	1.54	1.09	42
Mult. Perf. Die	2.65	1.70	.95	36
M. P. Die Top Insert	.77	.64	.13	17
Finish Master Cup	2.32	2.21	.11	5
Ring Master	2.22	1.59	.63	28
Pressure Ring	2.55	2.33	.22	9
Blanker Die	3.77	2.60	1.17	31
Cone Work Cup	3.63	3.35	.28	8
Ave. Savings	$26.16	$19.79	$6.37	24%

Economies obtained by Timken Roller Bearing Co. by using graphitic hollow-bar tool steel for dies and gages.

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CARBIDE-TIPPED CUTTING TOOLS
A complete line of Circular Carbide-Tipped Tools, Expansion Reamers — Special Tools
Write for the Staples Standard Tool Catalog
THE STAPLES TOOL COMPANY, CINCINNATI 25, OHIO

METALS

(*Continued from page 94*)

Measures Proposed For Relief

In consequence an advisory committee has recommended that the Government make no call for the aluminum stockpile during the third quarter, that exports of aluminum scrap be limited to 500 tons per month, and that shipments to the Government account to be made by August 31 should be extended for two months.

Producers point out that the U. S. current primary output of 1,500,000 tons annually will probably be expanded to 1,716,000 tons by the middle of 1956. Imports of only 215,250 tons in 1954 were lower than expected because of the sharp economic pickup in Europe. However, larger imports are in sight for 1955-56 from Canada, Norway and Japan.

Urge Stockpiling Be Temporarily Suspended

Nevertheless, it appears that only a substantial decrease in Government stockpiling can bring much relief to industrial consumers. If this were done, the opinion is that salesmen for the producers would be looking for business instead of turning it down.

Small fabricators declare they are unable to obtain supplies of new metal and are obliged to pay a high premium for scrap, to the extent they cannot compete with the captive fabricating facilities of the producers.

Unlikely to Advance Price

In spite of the shortage there is little pressure for a higher price for

(*Turn to page 130, please*)

GM and Ford Pacts

(*Continued from page* 57)

of living index, rather than with each 0.6 per cent change. Skilled workers' pay increases averaging about eight cents an hour at Ford, a minimum of eight cents at GM, with some higher than that. In addition, both companies will establish funds up to two cents an hour on total hourly payroll for adjustment of wage inequities at local levels.

Vacations—Workers with 10 to 15 years of seniority get 2½ week vacations or equivalent pay instead of present two weeks.

Pensions—Benefits raised to $2.25 a month for each year of service from former $1.75. Thirty-year maximum on pension service credits is eliminated, and pension credits for employes with specified seniority and length of service are vested for the first time.

Group Insurance — Coverage increased for group life insurance to a maximum of $7,500 for General Motors and $6,400 for Ford. Sickness or accident benefits are increased by both companies to a maximum of $85 at GM and $76.80 at Ford.

Medical Benefits — Benefits are raised, and Ford for the first time includes families of workers.

Holiday Pay—Double time for holidays worked in addition to regular holiday pay and addition of a seventh paid holiday (half-day each on Christmas and New Year's Eves).

Differences between Ford and GM contracts were not major but included the following:

GM for the first time granted the union shop, under which about five per cent of its workers still out of the union will have to join to retain their jobs. GM also will pay its workers time and one-half for Saturdays whether or not a sixth day of work is involved, whereas Ford does so only when Saturday is the sixth day worked. GM also liberalized by 50 per cent the time allowed for union committee men to spend on business. Ford has had full-time union committee men under its former contract. In addition, there were several minor differences in the two contracts relating particularly to each company's particular operations.

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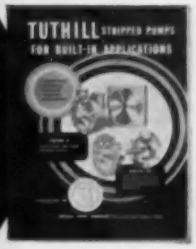
. . . Write for Tuthill Catalog 106 on stripped model pumps



Catalog 106 shows the line of Tuthill rotary, internal-gear positive displacement pumps available in stripped form for built-in applications.

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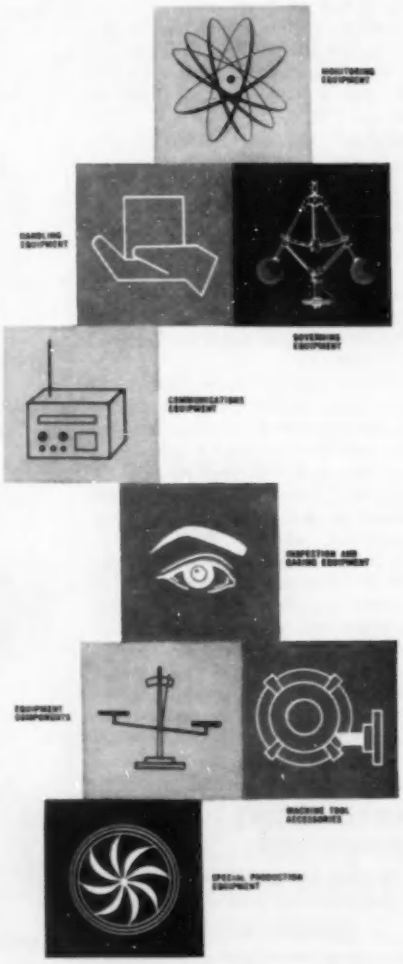

THE MACHINE TOOL SHOW

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INTERNATIONAL AMPHITHEATRE
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THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

* Estimated Attendance, Before Receiving Your Reservation

METALS

(*Continued from page 126*)

the metal. While one major producer declared the price is too low in relation to the cost of production facilities, this view was vigorously opposed by an offical of Alcan, who said that valuable markets would have been lost to aluminum if the price had been increased as shortages developed.

It appears likely that the moribund third round expansion in production capacity will be encouraged by Washington. Notable is a proposal by St. Joseph Lead and Pittsbury Consolidated Coal to build a 66,000 ton plant to cost $85 million in Pennsylvania, using coal for fuel.

Continued Heavy Call For Copper

Domestic copper production is up 30 per cent over last year, yet demand gives no sign of abating even in the normally slow summer months. This is the more surprising because actual consumption is about balanced by domestic production plus imports. There is no actual shortage of the metal.

It appears, therefore, that demand is exceeding consumption, and by rather a substantial margin. Consumers are anxious to fill pipe lines and rebuild inventories. They anticipate possible strikes and shutdowns when wage demands are encountered, and are asking for more copper than they are actually using.

Foreign Price a Puzzle

The copper price situation is puzzling. The domestic market continues to hold strong at 36 cents per lb and producers are opposed to any advance at this time. Overseas the powerful Prain group in London is still offering Rhodesian copper to its customers at 35 cents. But copper on the London Metal Exchange has advanced to above 41 cents, with strong demand from the Continent. How long this anomalous situation can persist is anyone's guess.

It is believed that more Government copper may be diverted from the stockpile for consumer's use. Producers say that their contracts with Washington must be modified to do this. The situation in mid-June was far from clear, but the chances are that the Government will acquiesce. This would affect about 17,000 tons in the third quarter.

Higher Zinc Price Anticipated

While nearly everyone in trade circles was forecasting an increase in the zinc price above 12 cents per lb, the market held stubbornly to this level through mid-June. Statistics for May by the Zinc Institute showed another cut in stocks to 63,184 tons, less than three weeks' supply at current shipment rate. Unfilled orders at the end of the month showed another increase. Demand for zinc was strong. New Jersey Zinc Co. advanced its quotations for zinc oxide by ½ cent per lb.

Successful termination of the wage negotiations with the automobile workers without a strike has heartened the diecasters, now running close to the galvanizers as a prime market for zinc. It is thought that the price advance cannot be long postponed, and it is known that the Government would not object to paying as high as 13 cents for the metal for stockpiling.

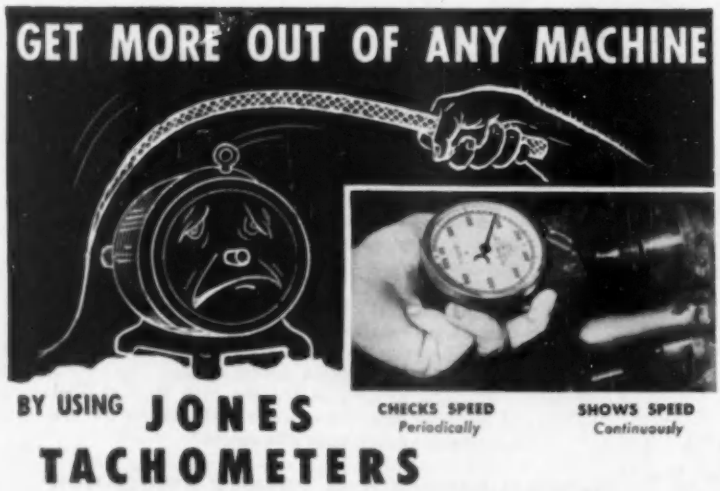
White Color On Cars Gains New Popularity

Changes in automobile color preferences and the steady decline in one-color cars in the past five years are charted in a recent Chevrolet survey. The study also shows a new trend toward the use of white, a color virtually non-existent in the automobile industry only three years ago.

More than half of Chevrolet's current orders call for sharply contrasting two-tone color combinations. Lighter hues continue to gain such popularity that paint companies constantly are developing new ones.

Chevrolet notes that its 1955 sports coupe, for example, is offered in 11 two-tone options, compared with only four in 1950. Solid green, blue, and black Chevrolet sedans accounted for only 30 per cent of total output in April, compared with 70 per cent at the same time five years ago. Black fell far down the list to represent only five per cent of total output.

Most automobile manufacturers today offer some variation of white. Forty per cent of the cars Chevrolet shipped recently carried white in one form or another.



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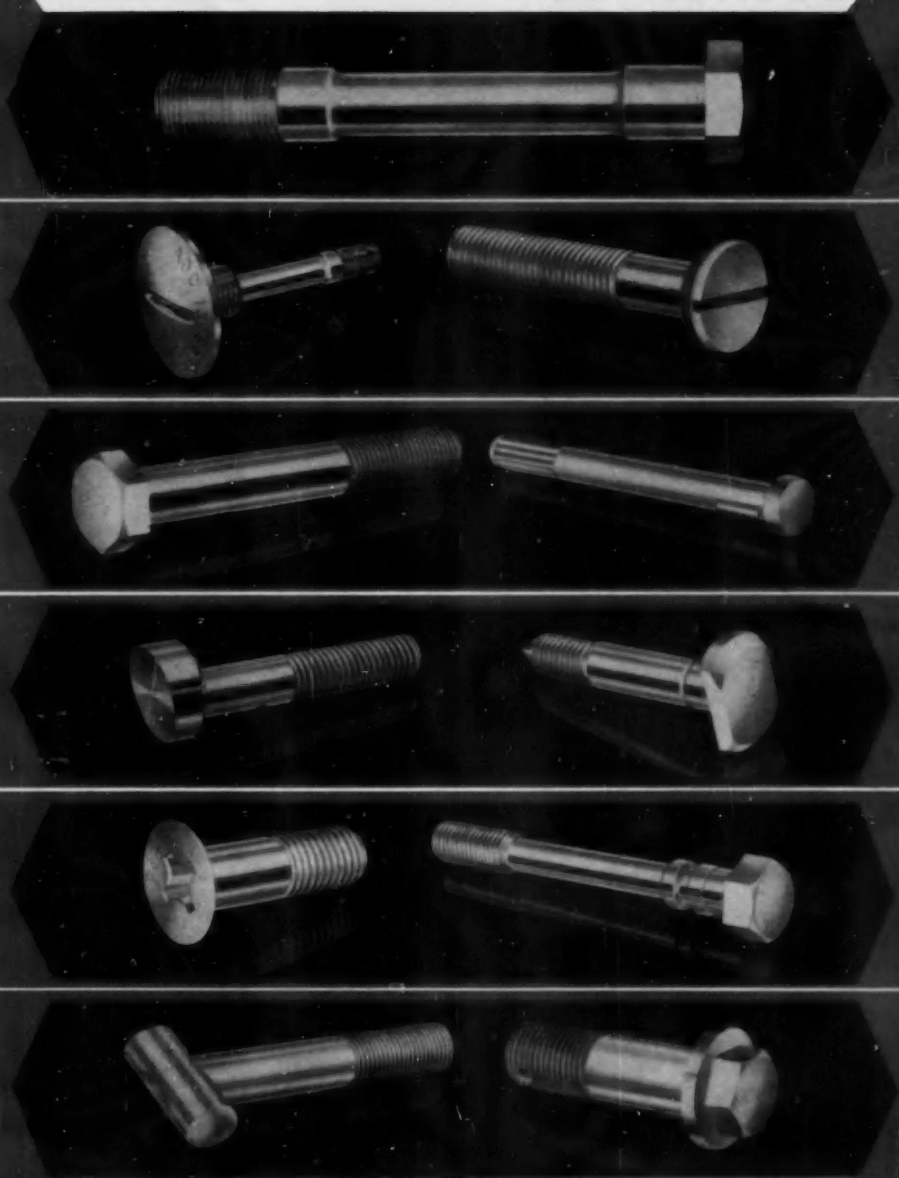

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SEPTEMBER 1, 1955

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Automotive and aviation executives attending these shows will have a timely preview of the outstanding new equipment on exhibition, with a special section keyed to each show. For those unable to attend, the Machine Tool and Production Equipment Issue will be a valuable "show in print."

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- PRODUCTION ENGINEERING SHOW
- COLISEUM MACHINERY SHOW

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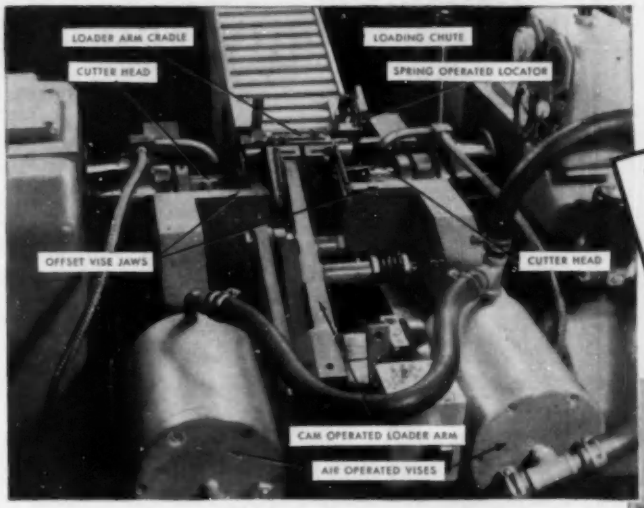
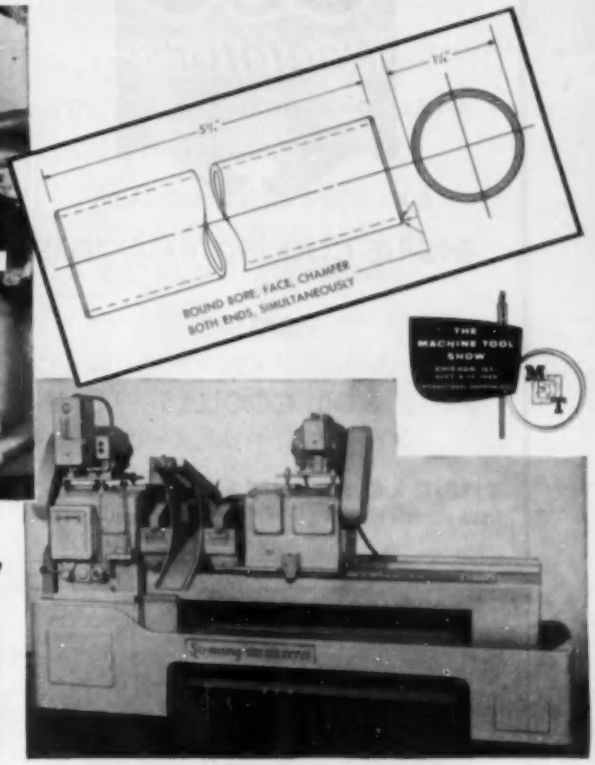
THE NEWS MAGAZINE OF AUTOMOTIVE and AVIATION MANUFACTURING

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK





MODEL "CS" Lo-swing SPEEDS MACHINING OF SHOCK ABSORBER TUBES

Problem: To automatically load, unload and machine both ends of Hydraulic Shock Absorber Tubes at high production rate.

Solution: The Model "CS" Lo-swing Automatic Drilling and Centering Machine selected for this job was equipped with an automatic loader of the type shown in the small illustration.

The tubes, which are cut 1/16" over the required length, are fed into the upper chute, shown in the large illustration, and ejected into the lower chute after being machined. Details of the loading arm, which is cam operated, are also shown in this illustration. Tubes are fed by gravity down the loading chute into the loading arm cradle where they are properly positioned lengthwise by a spring operated locator. The loading arm then lowers the tube into the air-operated vise jaws where it is securely clamped, after which the loading arm is raised to pick up the next piece.

When the loading phase of the cycle is completed, the two revolving cutter heads advance in rapid traverse and slow down into feed just before the tools reach the work. Three cutters are used in each head . . . one cutter for facing to overall length, one for rounding the bore, and one for chamfering the O. D. The machining completed, the cutter heads retract in rapid traverse and the vise jaws open, allowing the finished part to drop into the unloading chute. The complete cycle is slightly under five seconds per piece, assuring a production of 750 pieces per hour.

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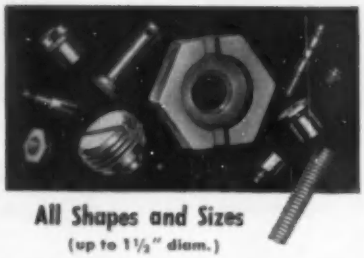

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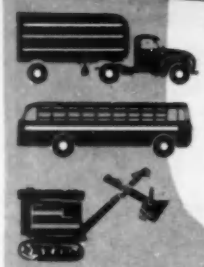

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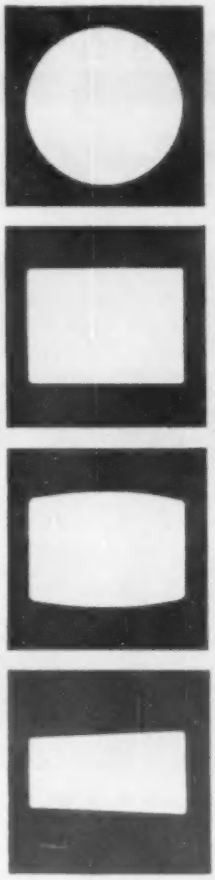

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The broadest product line in the anti-friction field.

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Constantly working to broaden the SKF line—to make "the right bearing in the right place" a watchword throughout industry, SKF has recently introduced new lines of pillow blocks, styles and sizes of Max type ball bearings, the improved Type "C" Spherical roller bearing.

And *now* SKF offers Tyson Tapered Roller Bearings.

This means that from SKF you get the broadest range of types and sizes of anti-friction bearings *and* the most extensive anti-friction experience.

More today, than ever before, dealing with SKF Field Engineers assures you of the right bearing in the right place. 7646

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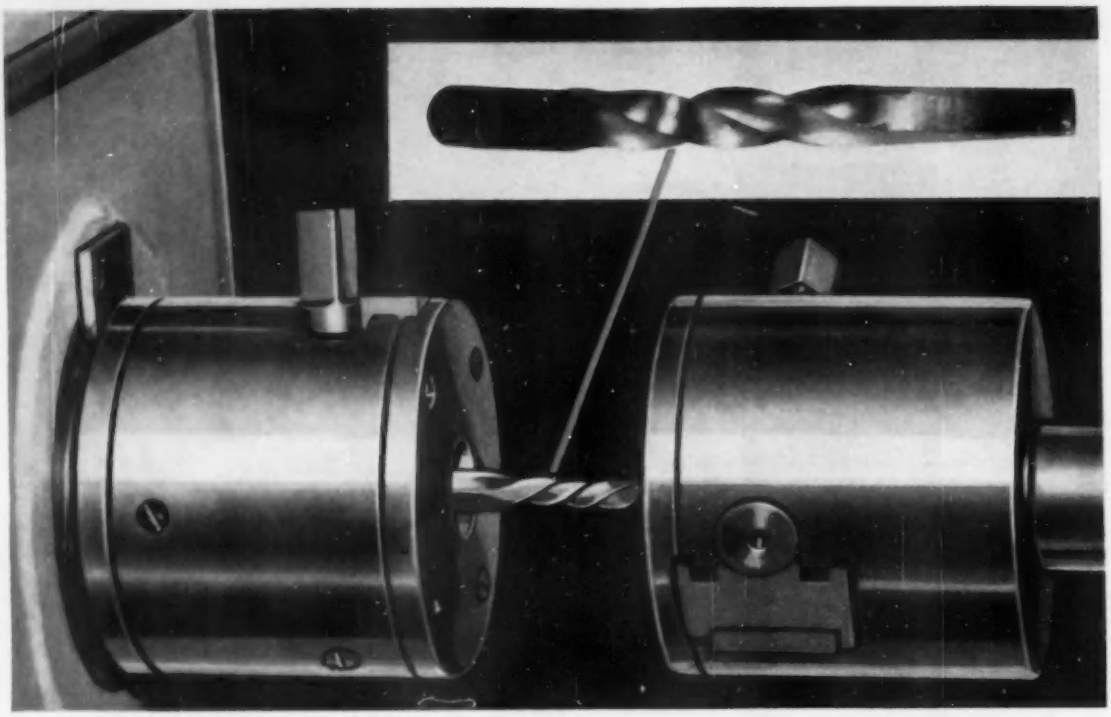

New STEEL OILITE'S unusual ductility is demonstrated in this photo of a typical torsion test. This revolutionary material was developed by Chrysler for applications requiring extreme ruggedness.

NEW Ductile STEEL OILITE® Opens Up New Uses for Powder Metals

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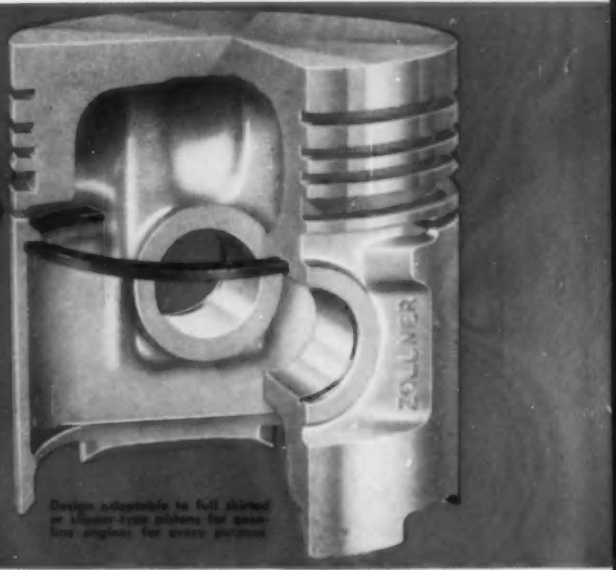
UNIFORM CLEARANCE AT ALL TEMPERATURES

STEEL TENSION MEMBER

Anchored only at pin bosses and cast in positive contact with I. D. of piston skirt

Controls Clearance Automatically

ZOLLNER CLEAR-O-MATIC PISTONS



Design adaptable to full skirted or slipper-type pistons for gasoline engines for every purpose

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2. Effective expansion identical with ferrous cylinder.
3. Steel tension member, with same effective expansion as cylinder, maintains uniform skirt clearance through entire temperature range.
4. Normal diametric clearance usually less than .001 with uniform skirt bearing.
5. Durability and conductivity comparable to heavy duty design.

ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

ZOLLNER

- **ADVANCED ENGINEERING**
- **PRECISION PRODUCTION**

in cooperation with engine builders

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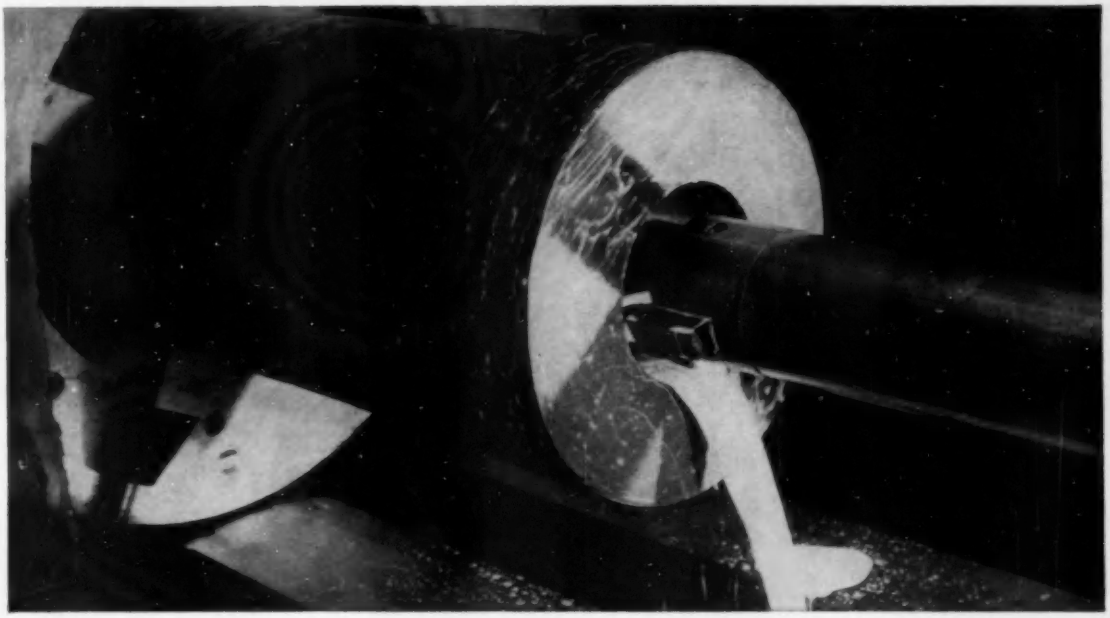

TIMKEN® seamless steel tubing saves steel, machining time!

FINISH boring is your first production step when you use Timken® seamless steel tubing instead of bar stock for your hollow parts jobs. You don't have to bore out the center hole. With Timken seamless tubing, it's "built-in"! So screw machine stations are available for other jobs. You add machining capacity without adding machines.

Because the center hole is already there, you also save steel with Timken seamless tubing. There's far less metal to machine away, giving you more parts per ton of steel.

To save you even *more* steel, the Timken Company's engineers will study your problem and recommend the most economical tube size for your hollow parts job—a size guaranteed to clean up to your dimensions.

Timken seamless tubing results in a better quality product, too. The piercing operation by which Timken tubing is made is basically a forging operation. This gives the tubing a uniform spiral grain flow and a refined grain structure that brings out the best in the quality of the metal. And this quality is uniform from tube to tube and heat to heat, due to the Timken Company's rigid quality control. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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